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#### PHYSIOLOGICAL EFFECT OF HIGH-FREQUENCY CURRENTS.

An article by Dr. A. E. Kennelly and Mr. E. F. W. Alexanderson in this issue contains a report of a series of convincing tests relating to the physiological tolerance of alternating currents of high frequencies. The tests reported cover facts concerning which much has been written during the past 20 years, but they differ from the earlier tests in that exact measurements were made of the physical quantities involved, while many of the former reports were based on approximations involving a considerable amount of guesswork in connecting the unknown quantities with the data determined. The currents used in the present experiments were obtained directly from an alternator capable of producing any frequency up to 100,000 cycles per second; the currents were measured immediately at the point of application to the bodies of the subjects by means of a hot-wire ammeter, while the e.m.f. required across the body to produce the known current therein was measured by a hot-wire voltmeter. It would be difficult to devise a better method for determining without error the physical quantities dealt with. As was to have been predicted from the knowledge of results obtained by earlier experimenters, the higher the frequency, the greater is the electromotive force that may be impressed between the hands of a person without discomfort. However, even at the highest frequency of 100,000 cycles per second, the permissible electromotive force does not come within the range of values—that is, among the thousand volts—repeatedly mentioned in connection with high-frequency experiments. The highest value reached was only 360 volts with one subject, which value was 50 per cent greater than that obtained on any of the other five subjects. The present authors connected the subjects directly to the terminals of the alternator, while most of the earlier experimenters seem to have inserted the subjects in series with certain impedances across secondary circuits, and the physical measurements were either ignored or confined to an observation of the current and a guess at the voltage.

Viewing the results from strictly a physical standpoint, the circuit through the body from one hand to the other represents an impedance which has a value of perhaps 1250 ohms at 60 cycles, and 500 ohms at 100,000 cycles. The reduction in impedance with increase in frequency indicates that the "skin effect" is either absent or greatly overshadowed by other effects. The report of the experiments does not contain data for determining to what extent the body acts as an electrolytic conductor, or how much the variation in impedance is attributable to a decrease in resistance with an increase of either the current or the frequency. If one were permitted to assign a constant value to the resistance of the subject, he would be justified in concluding that the human body is in effect a condenser, between the plates of which there is a dielectric of high resistance and low specific inductive capacity. It is highly probably that this analogue is correct, but that the resistance

is not constant and the capacity is subject to change. Just what relation exists between the electricity for charging the human condenser and the physiological tolerance remains yet to be determined, but the experiments by Messrs. Kennelly and Alexanderson indicate that a more or less definite relation does exist.

#### ELECTROMAGNETIC THEORIES OF DYNAMO-ELECTRIC MACHINERY.

It is almost self-evident that the same fundamental laws of energy, in relation to electromagnetism, underlie the behavior of all dynamoelectric machinery, such as generators, motors, and transformers, whether utilizing three-phase, single-phase, or direct currents. In every case we have the interactions of electric currents and of magnetic fluxes. Nevertheless, the working theories used by designers of these different machines differ in considerable detail. Not only the formulas used in designing a direct-current generator and a transformer are different, but the methods of apprehending their respective phenomena are different. A series of articles, by Dr. Hermann Zipp, have lately appeared in *Elektrotechnik und Maschinenbau*, setting forth a nearly uniform geometrical basis of consideration for the behavior of all types of dynamo-electric machines. It employs a vector magnetomotive-force diagram, on which are drawn three important vectors; namely, an impressed m.m.f., a line-current operated m.m.f. and a resultant m.m.f. The product of the two latter components is then developed and from the result, the power generated or absorbed by the machine is deduced. There is considerable interest in any method of converging electromagnetic operations in machines of different classes, but it is doubtful whether, in this case, there is any practical advantage in its adoption.

#### HARMONICS IN CURRENT AND VOLTAGE WAVES OF TRANSFORMERS.

Among the papers scheduled for the Jefferson convention of the American Institute of Electrical Engineers, but actually read recently at the San Francisco meeting, was one of the above title, by Mr. John J. Frank. A point of special value in this paper is the large number of oscillographic records which it incorporates. The deductions expressed in the paper are readily checked and corroborated by reference to these oscillograms. The value of the oscillograms would have been further increased, if a scale of ordinates in volts or amperes had been inscribed with each; but fortunately a considerable number are analyzed harmonically by the schedule method of Prof. S. P. Thompson. The paper has important theoretical as well as practical bearings. From the theoretical standpoint, the results indicate that the harmonics in the excitation current-wave of a transformer carry no resultant cyclic energy, and so have no effect upon the area of the hysteresis loop for the core. They affect only the shape of that loop. Consequently, if we analyze out the fundamental sine-wave from the complex current-wave in a transformer, the hysteresis loop, drawn with the aid of this fundamental wave, will be an inclined ellipse, containing the same area as the distorted hysteresis loop drawn with the aid of the complete complex wave. The two loops, thus compared, will coincide on the axis of abscissas, and will also extend through the same range of ordinates. If, moreover, the above fundamental current-wave be split into two components, respectively in and out of phase with the im-

pressed sinusoidal voltage, and a hysteresis loop be drawn with each component in turn, the former will give rise to a vertical ellipse of the same area as before; while the latter will give rise to an inclined straight line, or ellipse of vanishingly small area.

From the above viewpoint, the excitation current of a transformer under sinusoidal impressed voltage may be regarded as a fundamental sine-wave which supplies all the energy to the core, and another fundamental sine-wave in quadrature with the latter, which supplies the pure magnetization, plus higher harmonics, due to cyclic changes in permeability of the core, but otherwise without energy effect. This means that we may consider the essential operations of any transformer, at any load, as due entirely to currents of the fundamental frequency of the circuit, provided that the impressed voltage is sinusoidal. Some of the above deductions were arrived at by Mr. Charles K. Huguet in a paper presented before the Institute a number of years ago. From the practical standpoint, the paper throws much light on the behavior of single phase transformers when connected in three-phase groups. If we take a group of three such transformers, with their primary windings connected in star, and their secondaries either also in star or in opened delta, some remarkable phenomena occur when the group is excited from ordinary three-phase mains. With impressed sinusoidal voltage between mains, one would suppose, at first thought, that the voltage across each individual primary winding, or branch of the star, would likewise be sinusoidal. It sounds, at first, like a contradiction in terms, that when the three main voltages of the impressed primary system are all sinusoidal, the component branch voltages in the three branches of the star group between each main and the neutral are distorted. Nevertheless, they are distorted, and the oscillograms in the paper, taken with commercial transformers under practical conditions, show very marked distortion. Moreover, the three primary transformer voltages, instead of being each 58 per cent of the main voltages between wires, may be each 66 per cent of the same; and the maximum cyclic value of each primary transformer voltage, instead of being 58 per cent of the maximum cyclic main voltage, may be 86 per cent of the same.

The explanation for the above anomaly lies in the fact that any transformer with an iron core, and therefore with hysteresis, requires a triple-frequency component of current in its excitation. But no symmetrical star connection from a three-phase system can carry a triple-frequency component of current, because it is easily shown that such a component would mean that the total instantaneous current arriving at the neutral point would not be the same as the total instantaneous current departing therefrom. In other words, the neutral point would have to store and discharge electricity in each cycle, in order to permit of a harmonic frequency of three times the fundamental. This restriction does not apply to frequencies of 5, 7, 11 or 13 times the fundamental. Therefore, the three transformers in the star group must get on as best they can without any triple-frequency harmonic current. They work, and excite themselves, but with a powerful triple-frequency component in voltage—or with a cyclic distortion in their voltage that the missing component of current would eliminate. If, however, the secondary windings of the transformers are connected in a closed delta, a triple-frequency current will flow

around this delta, and will automatically smooth out the disturbance to a considerable extent. Curiously enough, the paper shows that if the group of three single-phase transformers be replaced by a single star-connected three-phase transformer—that is, a transformer with three interlinked magnetic cores symmetrically arranged to carry three-phase magnetic fluxes, each associated with primary and secondary windings—then the distortions, in the primary star branches do not occur, whether the secondary windings are closed or not. In this case the magnetic reactions between the three component magnetic fluxes are such as to prevent the above-mentioned distortion in branch voltages from taking place, although the primary currents can have no triple-frequency components. This fact constitutes a distinct advantage in favor of three-phase transformers over their equivalent single-phase groups. Preference is usually accorded to the latter in this country because an accident to one component does not necessarily put the group out of commission. In Europe, however, the three-phase transformer is in much greater use and favor and deservedly so.

#### MAGNETIC STORMS.

Some recent investigations reported in the foreign journals tend to throw new light on the origin of the magnetic storms that from time to time sweep over the earth with startling effect on the magnetic elements, with frequent demoralization of service on grounded telegraph and telephone lines, and with the usual accompaniment of flamboyant displays of aurora in the heavens. The connection of these phenomena with great solar activity as shown by sun spots has long been known and accepted as a fact, evident, but not fully explainable. Indeed, it has only been within a year or two that the direct connection of sun spots with electromagnetic solar activities has been shown. The discovery by Hale of Zeeman's effect in sun spots, with consequent discovery of the nature of the direction and magnitude of the magnetic forces involved, is one of the notable contributions of the last quarter century to solar physics; but the connection of the tremendous magnetic fields thus brought into evidence with the magnetic storms and their accompaniments on earth is still far from clear.

When the relations of these phenomena were first noted it was assumed that the connection was a direct electro-dynamical one, the solar disturbance being propagated by free waves in the ether and producing powerful inductive action upon the earth and its surrounding atmosphere. It did not take many years, however, to bring out the fact that between the primary disturbance on the sun and the secondary disturbance on earth there was not the accurate synchronism required by this hypothesis. If a visible outburst upon the sun was the immediate cause of electromagnetic disturbances here, the latter should follow the former by approximately eight minutes. In point of fact the interval, so far as it has been discovered by the rather incomplete data available, amounts instead to several or many hours. More recently, however, the hypothesis has been advanced that disturbances on earth are not thus directly produced, but that they are the consequence of the incidence on the earth and its surrounding envelopes of streams of electrons, or more generally, of electrified material, poured out from the sun during periods of extraordinary activity. Such streams would be competent to produce powerful electrical disturbances, and their existence, at least near the sun, is rendered exceed-

ingly probable in view of the now known facts regarding the magnitude of the causative forces in the sun spots.

Whatever the actual cause the resulting disturbances are practically world wide. The great electromagnetic storm of last August was recorded in all quarters of the globe, while the brilliant auroral display of March 28 last was observed in extraordinary splendor at least from Scotland to the Saskatchewan country and very likely much further, and at practically the same time. Now the projected matter theory accounts sufficiently well for the observed delay between sun spot disturbances and the terrestrial response, assuming that we can judge of the time of starting by the mere fact of the sun spots sweeping around as nearly as may be in the earth's direction. It is, of course, not certain just what direction the electron streams would take from the solar surface, nor is it by any means clear whether they are irregular outpourings from the sun spots or occur only at certain periods of convulsive activity. The exhaustive studies of the solar surface now being regularly made at Mount Wilson should throw some light on this point, but in any event it is perhaps too much to expect an accurate initial epoch to be decided upon when one considers merely a stream sent forth with unknown direction and velocity from a center of disturbance on the sun to a point somewhat over 100 solar diameters distant.

The studies of Professor Ricco on the time relations between sun-spot transits and electromagnetic storms show that the latter are delayed by a little over 40 hours than the average, corresponding to a velocity of a little less than 1000 km per second for the projected matter, a figure which agrees sufficiently well with the known velocities of the particles emitted from terrestrial sources. It has been objected to this theory of electromagnetic storms, that the electrostatic forces in action should cause a much greater disturbance of potential gradient above the earth's surface than has ever yet been observed in connection with such storms. The natural and promptly made response to this objection was that the upper regions of the atmosphere contain strata of a density which gives relatively good conductivity and such strata to a very considerable extent must act as an electrostatic shield. It is within these very regions of the atmosphere that the intense activity of the aurora is peculiarly manifested, reaching over enormous areas and at just such times as magnetic storms are felt in the regions below.

A very recent addition to the theory of this interesting subject has been made in bringing to light preliminary symptoms to magnetic storms—well-defined, small, but sudden variations in the magnetic elements occurring some hours before the outbreak of the main storm. This preliminary disturbance, which is generally of very short duration, was conspicuous in the great storm of last August and was world-wide in its effect. Such symptoms antedate the storm itself by very varying amounts, sometimes only a couple of hours, sometimes more than half a day. They very naturally suggest that terrestrial electromagnetic disturbances may be connected by more than one linkage with those upon the sun. For instance, it is not at all inconceivable that the preliminary disturbance may reach us in the form of free electromagnetic waves taking their origin at the beginning of the period of electronic eruption which ends in the more powerful and enduring phenomena observed on earth.

### Results with Edison Storage Battery Car.

The Edison-Beach car installed on the Twenty-eighth and Twenty-ninth Street Crosstown Railroad, New York City, has now been in operation since the first of the year and under continuous test most of the time. The result of tests for three months made between March 2 and June 1 are now available. These tests may be taken as representing the performance of the car under more adverse conditions than would be encountered in practice on roads of ordinary conditions. The road is made up of 4.77 miles of track laid with various forms of rails ranging in weight from 47 lb. to 109 lb. per yard. There are 46 curves on the road and a 3.5-per cent grade 1000 ft. long. The track was built for horse-car service and no attempt has been made to maintain it. The car runs between the east and west side ferries, and carries an average of 15 passengers, the car making about 458 full stops a day, which is equivalent to eight stops per mile. The maximum speed capacity in this service is 15 miles per hour.

The car was described in these columns Jan. 27, 1910. It is of the single-truck closed type, with a seating capacity of 26 and standing room for 15 more passengers. In one instance the car under test carried 70 passengers. Empty it weighs 10,000 lbs. and 12,400 lbs. with average load. The power equipment consists of two 5-hp, 110-volt motors and 100 A-8 Edison cells for the motor energy and five cells for lighting. The maximum distance which the car has covered in this service on one charge is 86 miles.

During the three months of the test the car was on the road 1132.5 hours and covered 5152.5 miles, which is an average of 57.25 miles per day of 12 hours 35 minutes. The battery is charged once a day, the charge lasting 4.4 hours and taking place at 185 volts and 60 amp.

The total daily energy input to the battery is 48,840 watt-hours and the battery output measured at the motor brushes is 30,280, giving an energy efficiency of 62 per cent. Reducing the total energy consumption to a unit basis, the gross energy input to the battery for this service was 137 watt-hours per ton-mile, and based on motor consumption, 85 watt-hours per ton-mile, the schedule speed being 4.77 miles per hour with eight stops per mile and an average running speed of 5.74 miles per hour.

Up to the present date the car has run more than 10,000 miles on the worst kind of track and in all kinds of weather. During this period there have been no repairs to the car or battery except the renewal of one motor brush and the addition of 70 gal. of water to the battery.

### The Patent Caveat Abolished.

Among the last bills to be passed by Congress before adjournment was an act abolishing the patent caveat. The caveat has been a distinctive feature of American patent law, and had for an object to protect an inventor who desired further time in which to mature an invention. The caveat, which was operative for a year, but could be renewed from year to year, set forth the object and distinguishing characteristics of an invention, and was filed in the confidential archives of the Patent Office. No patent could issue on a similar invention without notice to the caveator, who thereupon was expected to file his application. The use of the caveat has been largely curtailed through the practice of inventors in making record of supposed inventions and appending their signature together with those of two or more witnesses. The Patent Law Association of Washington and the Commissioner of Patents favored the bill passed.

The bill was introduced in the House by Representative Gustav Kuestermann, of Wisconsin, who declared that through the use of the caveat great abuses have been practiced and the life of patents has been extended many years longer than the law contemplates.

"The caveat bill is merely an entering wedge," said Mr. Kuestermann. "The entire patent system in this country needs an overhauling. It took a long, hard fight to get through this

one small measure. But the ice has been broken. I have pending in the committee other bills that will go far toward making our patent laws the best in the world. And I am confident these bills will be enacted into law eventually. When the required changes are made in the existing laws, every patent issued by the United States will have behind it the absolute guarantee of the Government, and a poor inventor will have an equal chance with the man or concern of large means."

### Priority of Invention of the Compensated Repulsion Motor.

The *Patent Office Gazette* of July 12 gives a decision by the U. S. Patent Commissioner on appeal from the Examiners-in-chief in a case involving priority of invention of the compensated repulsion motor. Two patent applications, both owned by the General Electric Company, are in the Patent Office which involve the invention of this motor, filed respectively by Winter and Eichberg, of Germany, and Marius Latour, of Paris, France. It is stipulated in the suit that Winter and Eichberg made the invention in issue in Austria, November, 1902; reduced to its practice in December, 1902, and disclosed it to Mr. E. J. Berg, of the General Electric Company, early in January, 1903; that Berg on Jan. 10, 1903, transmitted a written description of the invention to the officials of the General Electric Company, which was received at Schenectady by Mr. E. W. Rice, Jr., and read by him on Jan. 24, 1903. On Jan. 14, 1903, Winter and Eichberg filed an application for a patent on the same invention in Germany, and subsequently other applications for patents were filed in various other countries. It is stipulated on behalf of Latour that application for the same invention was filed by him in France Jan. 21, 1903, and that applications were also filed in other foreign countries, the date of the United States application being Jan. 19, 1904. The opinion states that Germany did not adhere to the international convention for the protection of industrial property until May 1, 1903, which is subsequent to the filing of the Winter and Eichberg application. It was therefore held that they are not entitled to the benefit of the filing date of the German application. On the other hand, there is no question that they are entitled to the date of Jan. 24, 1903, when knowledge of the invention was communicated to Mr. Rice in this country. It was further held that Latour is entitled to the date of the filing of his French application with the same force and effect as if the application had been filed in the United States upon the same date, Jan. 21, 1903. As this is prior to the earliest date which could be granted to Winter and Eichberg, namely, Jan. 24, 1903, the priority of invention was awarded to Latour by the Examiners-in-chief, and this was upheld upon appeal by the Commissioner of Patents. On appeal Latour was represented by Mr. A. G. Davis, and Winter and Eichberg by Messrs. A. G. Davis and John C. Pennie. The patent has not yet issued.

### Chicago Electric Vehicle Men Form an Association.

The Chicago Electric Vehicle Manufacturers' Association has been incorporated under the laws of the State of Illinois to promote the sale of the electric automobile and the proper care of the vehicle after it has been sold. The new organization is composed of manufacturers and dealers in electric automobiles and of storage-battery men, and all persons of this description engaged in business in Chicago, which is the greatest market for electric vehicles in the West, are eligible for membership. The association has elected officers as follows: President, Mr. L. E. Burr (Woods Motor Vehicle Company); vice-president, Mr. Ralph Temple (Baker Motor Vehicle Company); secretary, Mr. Godfrey H. Atkin (Electric Storage Battery Company); treasurer, Mr. J. C. Cooley (Waverley Company). The president and secretary of the association, with five directors, constitute the board of managers. These directors are: Messrs. E. Louis Kuhns (Studebaker Automobile Company), F. A. B. Smith (Rauch & Lang Carriage Company), John T. Fisher (Babcock Electric Carriage Company), F. E. Price (Ander-

son Carriage Company), and D. W. O'Brien (Columbus Buggy Company).

In the great impetus that has been given recently to the use of the electric vehicle, it has been realized that one of the serious drawbacks of the past was neglect, through ignorance or carelessness, of the battery. The new association proposes to bend its efforts to instruct owners and garage keepers in this important particular. Its aim will be to undertake the work in a systematic manner, and it expects to open a downtown office soon and to employ a salaried manager to look after the affairs of the organization. The association is organized not for immediate profit, but to promote in a general way the electric-vehicle industry of Chicago and vicinity for the benefit of all engaged in it.

### Convention of General Sales Agents of Large Electric Light Companies.

An informal convention of the general sales agents of the electric light companies of New York, Chicago, Philadelphia, Boston, Cleveland, Detroit and Brooklyn was held on July 11 and 12 at Briarcliff Lodge, Briarcliff Manor, New York. This was the first convention of its kind, and is the forerunner of others which will be held from time to time to discuss problems relating principally to the larger electric light companies of the country.

The program consisted of the following papers, not subject to publication: "Filing Systems," by Mr. R. S. Hale; "Collateral Duties of a Sales Department," by Miss S. M. Sheridan; "Residence Lighting," by Mr. E. W. Lloyd; "Standardization of Power Forms and Data," by Mr. J. W. Myers; "Canvassing by Telephone," by Mr. T. I. Jones; "Apartment Lighting," by Mr. J. F. Becker; "Contract Routine," by Mr. E. F. Tweedy, and "Electric Heating," by Mr. M. E. Turner. Those present were Messrs. R. S. Hale, L. R. Wallace and H. W. Moses, of the Edison Electric Illuminating Company, of Boston; J. F. Gilchrist and E. W. Lloyd, of the Commonwealth Edison Company, of Chicago; J. W. Myers and J. D. Israel, of the Philadelphia Electric Company; T. I. Jones and H. G. Disque, of the Edison Electric Illuminating Company, of Brooklyn; A. S. Pope and E. F. Tweedy, of the New York Edison Company; J. F. Becker and E. W. Rhodes, of the United Electric Light & Power Company, of New York; M. E. Turner, of the Cleveland Electric Illuminating Company, and Miss S. M. Sheridan and Messrs. B. J. Denman and G. D. Slaymaker, of the Detroit Edison Company.

### The New Street Lighting of Chicago.

Plans for improved street lighting in Chicago, adding to the present equipment of 12,000 lamps 10,000 others, the cost of installing which will be financed by the Sanitary District of Chicago, whose hydroelectric generating station on the Drainage Canal near Lockport will supply the energy for operating the entire 22,000 lamps, were discussed at the July 13 luncheon of the Chicago Electric Club. Mr. William Carroll, city electrician of Chicago, summarized the terms of the proposal, explaining how the city is to pay the district \$15 a year for each connected horse-power, energy to be taken about 11 hours a night or 4000 hours a year. The lamp consumption specified is 450 watts. The district will also take over and operate the city's transmission lines and substations, for which it will receive \$1 a lamp a year from the city. As the result of combining the transmission systems of the city and the district, both of which are public bodies, the city will gain the use of the district's lines in case of breakdown, while the latter will be able to utilize the city's lines for transmitting its commercial business when they are not required for lighting purposes. Maintenance of the distribution circuits and the lamps themselves will be retained by the city electrical department. The estimated saving to the city will be about \$27,000 a year for its street lighting. All of the first quota of lamps are to be installed in three years, and the city is to pay the district's outlay for financing the new lighting within seven years.

The absence from the meeting of Mr. E. B. Ellicott, electrical engineer of the Sanitary District, was explained by Mr. N. F. Obright, contract agent, who said that the very matter of the new street lighting itself had held Mr. Ellicott away, as amended drafts of the agreement were then passing between the district and the city offices, which it was expected would shortly reach an agreement on all details.

Mr. F. J. Postel called attention to the advantages of incandescent units, especially of the series tungsten type, for certain classes of lighting in residential sections, and also suggested that if possible the new wiring installation should be placed underground. Mr. Carroll said that careful experiments with series tungstens were being made, and that this type of illuminant would receive consideration in choosing the lamps to be used. As to underground construction at this time he pointed out that the clamor for additional lighting comes from those sections of the city which want, first of all, the lamps, and will willingly accept any overhead work in order to get them. As financial resources for construction work are limited, and as underground work would cost perhaps four times as much as overhead lines, Mr. Carroll fears that the suggestion to cut down by 75 per cent the number of lamps installed, in order to make the appropriation cover proper underground construction, would not be popular with the less discriminating communities needing the lamps. As the system is now planned, said Mr. Carroll, it is contemplated to district the lamps in sections of 1500 each, each district being served from a central substation from which underground feeders will radiate to the points of overhead distribution, thus requiring only single-wire circuits to be carried on poles.

Mr. J. G. Pomeroy brought up the interesting speculation that just as the arc lamp practice of the past ten or even five years has undergone a rapid change and advance, the future is likely to reveal similar progress which may leave the apparatus selected to-day far behind. He believed that the present metallic-flame lamp on direct-current circuits, and the impregnated-carbon flaming-arc lamp on alternating-current, present the best possibilities for the future as economical illuminants. Others who took part in the discussion were Messrs. W. A. Jackson, W. B. Jackson, A. L. Millard, W. R. Bonham, James H. Delaney, J. W. Mabbs, H. B. Gear and O. B. Duncan. Mr. Delaney was appointed chairman of the reception, or "glad-hand" committee and instructed to secure identification tags for members, and Mr. George H. Porter reported on the Electric Club picnic, to be held next month.

At the invitation of Mr. Carroll, who declared that his department would welcome any suggestions from the Electric Club on the subject of the installation of the new lamps, the club's regular committee on civic affairs was directed to cooperate with the electrical department and the Sanitary District in the matters of the choice of illuminants and the character of construction to be used. Prof. P. B. Woodworth is chairman of this committee, the other members of which are Messrs. W. L. Abbott, George H. Lukes, James Lyman, Kempster B. Miller, E. A. Rummler and T. P. Gaylord.

### Electricity in Colorado Mines.

The mining industry in Boulder County, Colorado, owes much of its present increased activity to the advent of the Central Colorado Power Company with its transmission lines rapidly extending over the county. Energy is now offered at less than half the cost of steam plants with existing coal prices. The management of the power company is also very much alive to the fact that increased mining activity means greater power sales, and it is actively boosting the development of Boulder County's mineral resources. Not only is it displacing steam plants and starting up plants which have been abandoned because of too great production costs, but is also rapidly displacing isolated water-powers because of their unreliability and because at certain periods of the year they must cease operation.

The two last water-power mills to contract for electric drive are the Wood Mountain Mill, at Wallstreet, and Wolf Tönhue

Mining & Milling Company, at Nederland. In both cases their water equipment was good for the summer months, and cheap. The cost of making the change was found to be trivial as compared with the continuity of service guaranteed, and the costs have actually been lower through the reduction of maintenance and supervision of the water-power plants. In a few cases where water-power plants have had break-down gasoline engine plants installed, the power company has been able to show costs of operation which have run very much lower than the gasoline costs. In one mine the cost for the same service per month for electricity was \$38 against \$194 for gasoline, with a cost per month per horse-power of \$5.61 for electricity against \$28.80 for gasoline. Similar economy has been attained in a number of instances and has done much to increase the use of electricity in the mines.

Among others the Eureka Tungsten Mining & Milling Company states that its motor bill at present is \$76 per month, or 50 per cent less than it would be with steam, although this plant is located at the edge of the city of Boulder, with comparatively cheap fuel cost. The Good Luck Mill states that its bill of \$400 per month for coal has been cut down to \$180 for electric energy, besides saving the wages for firemen and avoiding difficulties that go with delivering and handling coal several miles over mountain roads. At present the Central Colorado Power Company is supplying energy to the mining district from its Shoshone plant, but expects about the middle of August to operate the Boulder plant, when the reliability of its service will naturally be largely increased.

#### Mexican Hydroelectric Developments.

The waters of the rivers and smaller streams of Mexico are being rapidly put to use for generating electric power and irrigating the rich lands of the valleys. Preliminary steps have been taken during the last few months toward the installation of many hydroelectric plants in different parts of the republic. In many instances power and irrigation projects are combined. A number of applications of concessions of this character are now pending in the national department of Fomento.

Albert B. Fall is seeking a Government concession to use 14,000 gal. of water per second from the Aros River in the Guerrero district, Chihuahua, to generate electricity for use in mines. The plans for the proposed hydroelectric plant have been drawn and its installation will be started as soon as the concession is formally granted. D. J. Spillane has asked for a concession from the Government to use the water from the falls of the Gallinas River in the Santa Maria del Rio district, State of San Luis Potosi, to operate a hydroelectric plant which he is preparing to install there. The energy will be transmitted to mining and industrial centers of that region. The La Cruz Mining & Milling Company has applied for a concession to use 314 gal. of water per second from the Navosaigame River, State of Chihuahua, to generate electrical energy, which will be used to operate the machinery of the mines and mill of the company.

M. Dahgren has applied for permission to use about 16,000 gal. of water per second from the Champayan lagoon in the State of Tamualipas to irrigate a large tract of land upon his San Francisco hacienda. Charles E. Tamez wants a concession for the use of about 600 gal. of water per second from the Pabrillo River, in the State of Nuevo Leon, to irrigate a portion of his Purisima de Conchos hacienda. Pedro Loyola and Luisa L. Vda. de Campos will use about 1200 gal. of water per second from the Laja River to irrigate their lands in the State of Guanajuato if the Government grants their application for a concession for the purpose.

José E. Gaytan is preparing to establish a large irrigation enterprise in the valley of the Yaqui River, in the State of Sonora. He has applied to the Federal Government for a concession for the proposed system of irrigation, including the right to use the water from the river. José Valenzuela has applied for a concession to use the water of the Coaten River, in the State of Chiapas, to irrigate a large tract of land. Dionisio Garcia will construct an extensive irrigating canal system in the

State of Michoacan, to irrigate a part of his ranch if his application for a concession to use the waters of the Zitacuaro and San Juan Viejo Rivers for the purpose is granted. Hipolito Maldonado wants a concession giving him the right to use the waters from the San Juan and Las Liebras springs, near Agualeguas, State of Nuevo Leon, to irrigate his lands.

#### Dirigible Balloons and Electricity.

At a special summer joint meeting of the Chicago Section of the American Institute of Electrical Engineers with the Western Society of Engineers in the latter's rooms in the Monadnock Block, Chicago, July 8, Mr. W. A. Blonck, an electrical engineer of Chicago, who has just returned from a European trip and a study of dirigible-balloon construction abroad, gave an interesting talk, illustrated by lantern slides, on the subject of these craft. With the aid of diagrams he described the essential differences in construction between the three types of dirigibles now engaged in fierce competition in Europe—the rigid-frame, the semi-rigid and the non-rigid. The famous Zeppelin vessels are examples of the rigid type, the gas-bag envelope being reinforced by aluminum metalwork construction. The outer envelope encloses 17 or more small ballonets which contain the gas, applying the separate-bulkhead principle to prevent a local injury from disabling the entire lifting power of the dirigible. Horizontal steering is effected by rudders, and movement in a vertical plane is controlled by the tipping of louvres or horizontal rudders at the front and rear ends of the vessel. When properly set these louvres also assist by an aeroplane action in sustaining the vessel after a certain speed is reached. The semi-rigid construction employs a reinforcing keel for the single gas bag, while the non-rigid type has the car supported from the bag entirely by cables, maintaining a gas pressure of about 1 in. of water column to preserve the shape of the bag. The last type has the advantage of being entirely collapsible for transporting or for escape from a high wind. These latter dirigibles employ an aerostatic principle for steering in the vertical plane, being provided with a small pump for introducing air into one of two small air ballonets at the front and rear of the gas bag, thus displacing the gas and its lifting power at that end and tilting the whole vessel. As indicative of the great interest in dirigibles abroad, the speaker mentioned that even several of the large electrical manufacturing concerns there, notably the Siemens-Schuckert Company, have taken up the construction of these vessels.

Mr. Blonck made several trips in a dirigible and described the sensations experienced, the ease of control, and the beauty of the passing panorama. He does not think that the aeroplane, on account of its inherent high speed and its dependence for its suspension on continuous engine operation, will reach for many years the reliability and satisfactory travel already attained by the gas-supported vessel. The supply of cheap hydrogen gas, as a by-product from other manufacturing operations as in Europe, is essential to the practical development of aeronautics in the United States. A balloon loses from 1 to 2 per cent of its gas content each day, which must be replenished; and at the end of six weeks has to be entirely emptied and refilled on account of the infiltration of air which mixes with the gas.

A suggestion that lines of balloon carriers might be electrically driven by dragging trolleys taking energy from special trolley lines was scouted by Mr. Blonck, who pointed out that the freedom of travel opened up by air craft was one of their greatest advantages, and would be curtailed by trolley connection.

Mr. Blonck told of a new advertising scheme which had appeared in Berlin the week before. A dirigible has its propeller engine fitted with an electric generator for supplying a projecting lantern, and hovers over the city flashing signs on the gas bag, to be read by all the curious observers. The promoter is said to be reaping a fortune, and Mr. Blonck suggested that the method might be employed to even greater advantage in this country where advertising is carried out on a much more extensive scale.

### The "Wireless" Devotees of Chicago.

At this time, there are estimated to be not less than 800 amateur wireless-telegraph stations in Chicago. This figure, which has been made on a conservative basis, includes the total present number of active, dormant and neglected outfits in which the interest of their generally youthful owners is at various degrees of intensity. It numbers equipment ranging from the half-inch spark-coils of beginners, up to the high-powered stations of advanced amateurs, which are in all respects equivalent to the commercial outfits. In addition to the amateurs, there are three wireless-telegraph companies having stations in Chicago—the United Wireless Telegraph Company, the Great Lakes Radio-wireless Company and the Continental Consolidated Wireless Company. The first-named concern does a commercial business with its chain of wireless stations on the shore of the Great Lakes, and with 65 vessels equipped with its apparatus.

Amateur interest in "wireless" in Chicago finds expression in a club of 100 members, the Chicago Wireless Club, which holds meetings of an educational nature twice each month, on the second and fourth Fridays, in the Auditorium Building, Chicago. The membership of the club is limited to amateur operators who have wireless stations. The ages of the members range from 15 to 50. The purpose of the club is a double one—to provide practice in transmitting and receiving messages between members' stations, and to hold meetings at which specially skilled or experienced operators and electrical engineers address the club on subjects pertaining to "wireless."

The Chicago club has taken into its own hands the regulation of members' interference with commercial signals, a matter which has elsewhere recently echoed even to Congress. By agreement with the commercial operators, all club members having stations of over  $\frac{1}{2}$ -kw capacity are limited to special times for sending, during which the commercial stations and low-powered amateur stations are not at liberty to work. The "big" amateurs thus have the ether to themselves the first 15 minutes of each hour from 6 to 11 p. m., weekdays, and all day Sunday. If a low-powered operator wants to talk to one of the high-powered stations, he is instructed to wait until 20 minutes after the hour, and then to put in his message, which will be answered during the first quarter of the next hour.

An official call list is issued by the club, to be posted in all members' stations. Besides a brief enumeration of the "wireless" rules of the road and suggestions for improved transmission, the list gives the name of each member with his assigned call, consisting of two letters, as for example, "B G," and also his address and telephone number. Sometimes the last-named is useful for comparing notes when a detector sticks or a de-coherer slurs. Among the precepts of the "wireless" code of etiquette as promulgated by the club, are the following:

Don't misrepresent yourself by wireless or use some one else's call. Never test your spark or "warm up" an electrolytic interrupter, or adjust the vibrator of a coil without first disconnecting the aerial; it is not fair for you to monopolize the time by causing unnecessary interference. Don't interfere with commercial stations, or some day you will miss your antennae.

Until recently, the club sent out a "wireless" bulletin each evening, as a matter of practice for amateur operators in receiving. The bulletin usually consisted of an article of some electrical or telegraphic interest, about 120 words in length, and was transmitted, in succession, from some one of the 1-kw stations or over, every evening at 8 o'clock. These messages were sent slowly, at the rate of about 10 words per minute, and could be received all over the city. Sometimes the program was varied by sending passages in foreign languages, to quicken the receiving ears of the amateur operators. This practice of sending out general bulletins has, for the time being, been discontinued, on account of other activities among the wireless amateurs.

Several members of the club have stations of capacities up to 2 kw, the equal in power of the commercial apparatus at Chicago. The signals of these larger amateur stations are frequently received across Lake Michigan, and at a wireless-telegraph school at Valparaiso, Ind.

Original experiments with kite antennae have been undertaken by several of the Chicago amateurs. Both the box and Eddy-tailless forms of kites have been used for supporting the aluminum aerial wire, in this way attaining a vertical height of 800 ft. or more, which considerably extends the radius of transmission of a low-powered station. The field set used for this purpose consists of a 1-in. spark-coil energized from four dry cells, the whole outfit being arranged compactly in a suit case. With this apparatus, using the aluminum kite string as the aerial, a transmission distance of 10 miles is attained.

The officers of the Chicago Wireless Club are as follows: President, Mr. Royal C. Dickson; vice-president, Mr. John Hair; recording secretary, Mr. Selden Stebbins, and corresponding secretary, Mr. Ed. M. Mueller.

### Investigation of High-Tension Transmission in Massachusetts.

In accordance with Resolve 55 of the Legislature of 1910, the Massachusetts Gas & Electric Light Commission gave a public hearing on July 14 upon the conditions and laws surrounding the transmission of electricity for light, heat or motor service within the State, special consideration being paid to the transmission of energy in bulk over considerable distances and at high potentials. In opening the hearing Chairman Barker called attention to the importance of the subject and its possible technical and commercial difficulties. Notice had been generally sent to municipal authorities and managers of public utility companies in regard to the inquiry, which is to result in a report to the Legislature of 1911 by the Commission, with a discussion and recommendations concerning legislation bearing upon the larger transmission of energy in the State.

Mr. E. W. Burdett, for the Massachusetts Lighting Companies, Massachusetts Electric Companies, and Hyde Park Electric Light Company, stated that the laws of Massachusetts are to-day inadequate to handle large power developments properly, the statutes being absolutely silent in regard to much that relates to the construction and maintenance of lines. At present a town can block a worthy transmission development by standing in the way of the necessary line location. It is necessary to provide the power companies with the authority to exercise the right of eminent domain without the handicap of local obstructions.

Selectman Stone of Clinton voiced the difficulties which had beset his board of late in granting a location within the town to the Connecticut River Transmission Company. It was almost impossible for the selectmen to grant a franchise for the running of a line to the Lancaster Mills, the largest industrial plant in town, on account of the opposition of the public. Finally a location was obtained so that the circuits are carried partly on land owned by the State, in part over private property, and on but one short street. The difficulty was that political considerations carried too much weight with the public. The town authorities felt that the entrance of hydroelectric power was a public benefit to the community, but the troubles which were experienced pointed the way toward taking out of the hands of the local boards the opportunities to block progress. The company's trunk line operates at about 66,000 volts, but a limit of 14,000 volts was placed in the town itself.

Mr. Eugene Carpenter, Newton, Mass., operating lighting plants on Vineyard Sound, suggested the desirability of giving additional authority to the Commission in connection with power-line locations. He emphasized the benefits of centralized power generation, with long-distance transmission and wide local distribution in place of scattered and small plants. The Board should have the power to enforce agreements between local and power companies respecting the location of lines and the responsibility for their maintenance.

Mr. Thos. Robinson, of the Uxbridge & Northbridge Electric Company, said that the day of the small power plant is going by. He felt that one of the most important points to

be considered is that of good construction in all high-tension line work. He cited instances of distant fires caused by the grounding of a transmission line and suggested that all overhead construction should be standardized so far as possible under the supervision of a competent engineer to be employed by the Commission. This engineer would act in connection with local inspectors of wires. Mr. Robinson felt that the wires in the state should all be under one handling, and deprecated placing them under the jurisdiction of the Highway Commission, which now has supervision over telephone and telegraph lines. It was argued that the entrance of a large power company into a small local field is often a great benefit to the local company, since the incoming power relieves the existing company from an investment which might be too heavy for successful handling. In conclusion, Mr. Robinson said that large power companies should be under the supervision of the Commission in the same manner as central stations and gas companies.

Mr. S. H. Pillsbury, counsel for the Connecticut River Transmission Company, pointed out that under the existing laws a transmission company has no authority to compel either a town or an individual to permit its line to pass through the community. Any town may block any company regardless of the necessities of the case in a broad way. The great majority of states now give power-transmission companies the right of eminent domain. In but 12 states is there no legislation whatever on this subject. Mr. Pillsbury contended that the Commission should be the first authority to which a power company should come in seeking a location for its line in general. The company should be required to apply for a certificate of public convenience and necessity in the same way that an electric railroad goes before the Massachusetts Railroad Commission when it seeks the right to build over a general route. A map of the route should be filed and full opportunity given by the Commission for all parties interested to be heard in the case. If a town objects to the use of its streets and requires the company to build its lines over private land, the company should be allowed to take such land by right of eminent domain. Mr. Pillsbury said that it was his understanding that the Connecticut River Transmission Company is not a public service corporation under the existing law, but that status is fast approaching, especially when the right of eminent domain is granted. Some degree of regulation by the Commission would be desirable in case the right of eminent domain is given to power companies. In a case recorded an aqueduct company became a public service corporation by the grant of the right of eminent domain.

President Henry I. Harriman of the Connecticut River Transmission Company stated that his company has now been operating for about seven months, and that it is selling energy at the output rate of 60,000,000 kw-hours annually. All this output goes to 14 customers, and the total amounts to nearly half the total output sold by all the central stations in Massachusetts. The economy of the service has been evidenced by the securing of nine repeat contracts by the company. Energy is sold at rates varying from 1 to 1.5 cents per kw-hour to the larger customers. The average installation has about 700 hp in service and there are no customers using less than 300 hp, except in the town of Gardner. Mr. Harriman pointed out that the larger user can afford to put in the most economical equipment, so that it speaks well for transmitted energy that it can successfully compete with independent manufacturing plants. The larger water power possibilities now lie in the more remote regions. Mr. Harriman said that within a radius of 175 miles of Boston, Worcester and Springfield there are undeveloped water powers amounting to over 300,000 hp, which would go a long way toward turning every wheel within the state. He touched briefly upon the great advantages of large over small units, and pointed out the improvement in economy of investment due to a better diversity factor. Mr. Samuel Insull of Chicago has recently shown that if all the electrical service of that district could be supplied from one company the investment needed would be reduced by 33½ per cent on

account of the reduction of duplication. There are noteworthy economic advantages in the development of large water power and steam plants. Turning to the question of rights of way for high-tension lines, Mr. Harriman said that it was surprising how reasonable the public had been in the main in the purchase of over 400 rights for the company which he represented. There were from 10 to 15 per cent, however, that tried to impose extortionate charges, so that it is almost impossible to build lines across country without the right of eminent domain. If the work is attempted without this right, the cost of line construction is inevitably increased, and the result is that the public has to pay a larger charge for its energy than where lines can be put down according to the engineering needs of the situation. The law should be designed to provide for appeals to the Commission in cases of disagreement over line rights of way. Steel towers cannot properly be erected on streets, and as trees have to be cut for 50 ft. on each side of a high-tension line, the provision of the right of eminent domain is a genuine necessity to power companies.

Mr. W. H. Snow of the Holyoke Lighting Department said that he welcomed the coming of larger powers into fields which the smaller plants cannot well afford to occupy. Mr. W. R. Peabody, Boston, counsel for the Amherst Power Company and other interests in the Connecticut Valley, stated that his clients have had the same difficulties in securing line rights as were cited by Mr. Harriman. The State should do all it can to facilitate the entrance of water power in the interests of the ultimate consumer, and eminent domain is a necessity for such work. The progress of hydroelectric development in the Connecticut Valley is being held back by the absence of the eminent domain provision in the law. The right of appeal from the action of local authorities is important, and the law should be set forth so that local authorities cannot impose impracticable restrictions as to voltage at different town boundaries.

Commissioner Schaff stated at this point that it was his opinion that the right of eminent domain should not be granted to power companies unless in the grant there is a provision to the effect that the lines shall be put underground as soon as it is reasonable and practicable. He did not consider that country lines should be placed under the surface.

Mr. M. V. Jones, counsel for the New England Telephone & Telegraph Company, urged the necessity of eminent domain rights for power companies, and said that the telephone companies also need it. It is to-day extremely difficult to construct heavy trunk lines on the highways, and yet the cost of rights of way taken by purchase and not by eminent domain is apt to be very high. Joint use of poles is undesirable where any of the lines carry high potential current. General Schaff said that power companies given eminent domain should be required to make a complete exhibit of their receipts and expenses. Mr. Harriman spoke briefly on the engineering difficulties of placing circuits carrying over 20,000 volts underground. Mr. Mason, representing the Orange Electric Light Company, also appeared on behalf of the right of eminent domain for power companies, and central stations having transmission lines. The Board continued the hearing until Sept. 15 to hear further arguments bearing upon desirable changes in the laws concerning electric transmission.

#### Ohio Telephone Situation.

Reports have been current at Columbus, Ohio, to the effect that plans are being worked out in the office of J. P. Morgan & Co. for the organization of a company that will take over the Morgan properties in Ohio outright. This will probably be done through an exchange of securities, if the rumor is correct. The properties affected are the United States Telephone Company, the Cuyahoga Telephone Company of Cleveland, the Columbus Citizens Telephone Company of Columbus, the Dayton Home Telephone Company of Dayton, the Toledo Home Telephone Company of Toledo and the local exchanges controlled by the United States Telephone Company and the



Columbus Citizens Telephone Company. The belief is expressed that nothing will be done by the new organization until all the companies are brought up to a high standard. The plants at Cleveland, Columbus and Toledo are in good shape now, but improvements are contemplated for some of the others. The purpose of the new corporation is reported to be to get the properties into a company that will be of sufficient size to attract attention in financial circles and be more readily financed for the future.

#### Amendments to A. I. E. E. Standardization Rules.

At the White Mountain convention of the American Institute of Electrical Engineers, Dr. A. E. Kennelly, as chairman of the standards committee, submitted a report suggesting certain amendments to the standardization rules of the Institute. Below are given the amendments suggested, some of which represent additional rules and others merely revisions in old rules.

##### ADDITIONS.

6a. *Two-Phase*. A term implying the supply of power through two circuits carrying alternating currents which differ 90 deg. in phase.

9a. *A Compensated Alternator* is an alternator which automatically compensates for the drop in voltage in its armature, or in its armature and the line.

9b. *A Synchronous Compensator* is a synchronous machine running either idle or under load, whose full excitation may be varied so as to modify the power-factor of the circuit, or through such modification, to influence the voltage of the circuit.

11a. *An Inductor Alternator* is an alternating-current generator in whose armature windings the field magnet flux pulsates but never reverses.

11b. *An Induction Generator* is a machine similar to an induction motor, but driven as an alternating-current generator.

21a. *A Rotor* is a rotating member of a machine.

21b. *A Stator* is a stationary member of a machine.

21c. *Equalizing Rings* are rings connected to equipotential points of multiple-wound armatures to equalize the voltage between brushes.

23a. *A Primary Winding* is that winding of an induction motor or of a transformer which receives power from an external source.

23b. *A Secondary Winding* is that winding of an induction motor or of a transformer which receives power from the primary by induction.

Note: The terms "High-tension winding" and "Low-tension winding" are suitable for distinguishing between the windings of a transformer, where the relations of the apparatus to the source of power are not involved.

29b. e. *A Transformer-Balancer* is an auto-transformer for dividing a voltage in constant proportions, and usually into two equal portions.

29c. f. *An Induction Starter* is a device used in starting induction motors, converters, etc., when they are started by voltage control, consisting of an auto-transformer in connection with a suitable switching device.

29d. g. *A Leakage Reactance* is that portion of the reactance of any induction apparatus which is due to stray flux.

49a. *A Synchronoscope* is a synchronizing device which, in addition to indicating synchronism, shows whether the machine to be synchronized is fast or slow.

49b. *A Voltmeter Compensator* is a device used in connection with a voltmeter to reduce its reading by the amount of the line drop, and thus causing it to indicate the voltage delivered at the distant end, or at any other predetermined point of the line.

49c. *A Watt-Hour Meter* is an instrument for registering total watt-hours. This term is to be preferred to the term "integrating wattmeter."

49d. *Recording Ammeters, Recording Voltmeters, Recording Wattmeters* are instruments which record upon a time-

chart the values of the quantities they are designed to measure.

78a. a. *Indicating Meters* should be rated according to their full-scale reading of volts, amperes or watts (at unity power-factor in wattmeters).

78b. c. *Watt-Hour Meters* should be rated by their power delivery at rated volts and amperes at unity power-factor.

84. *The Efficiency* of an apparatus is the ratio of its output to its input. The output and input may be in terms of watt-hours, watts, volt-amperes, amperes, or any other quantity of interest, thus respectively defining energy efficiency, power efficiency, apparent-power efficiency, current efficiency, etc. Unless otherwise specified, however, the term efficiency is ordinarily assumed to refer to power efficiency.

When the input and output are expressed in terms of the same unit, the efficiency is a numerical ratio, otherwise it is a physical dimensional quantity.

86. *Apparent Efficiency*. The volt-ampere efficiency, or the ratio of volt-ampere output to volt-ampere input. In apparatus in which a phase displacement is inherent to their operation, apparent efficiency should be understood as the ratio of net power output to volt-ampere input.

##### REVISIONS.

9. *An Alternator or Alternating-Current Generator* produces alternating currents, either single-phase or polyphase.

20. d. *A Frequency Changer* converts from an alternating-current system of one frequency to an alternating-current system of another frequency, with or without a change in the number of phases or in voltages.

26. (a) *Compensator Potential Regulators*, also called contact regulators, in which a number of turns of one of the coils are adjustable.

29. d. *Reactance Coils*, sometimes called choke coils, are a form of stationary induction apparatus used to produce reactance or phase displacement.

216. *Condition of Apparatus to be Tested*. Commercial tests should, in general, be made with the completely assembled apparatus and not with individual parts. The apparatus should be in good condition and high-voltage tests, unless otherwise specified, should be applied before the machine is put into commercial service, and should not be applied when the insulation resistance is low, owing to dirt or moisture. High-voltage tests should, in general, be made at the temperature assumed under normal operation. High-voltage tests considerably in excess of the normal voltages to determine whether specifications are fulfilled are admissible on new machines only. Unless otherwise agreed upon, high-voltage tests of a machine should be understood as being made at the factory.

308. *Transmission Circuits*. In alternating-current constant-potential transmission circuits, the following average voltages are recommended: 6600, 11,000, 22,000, 33,000, 44,000, 66,000, 88,000, 110,000.

317. When white lights are used a light turned on should denote danger such as "switch closed" or "circuit alive"; while the light out should denote safety, such as "switch open," or "circuit dead." Low-efficiency lamps should be used on account of their lesser liability to accidental burn-out.

341. *Candle-Power*. The luminous intensity of sources of light is expressed in candle-power. The unit of candle-power should be derived from the standards maintained by the National Bureau of Standards, at Washington, D. C. The hefner is 0.90 of this unit. In practical measurements seasoned and carefully standardized incandescent lamps are more reliable and accurate than the primary standard.

342. *Candle-Lumen*. The total flux of light from a source is equal to its mean spherical intensity multiplied by  $4\pi$ . The unit of flux is called the lumen. A lumen is the  $\frac{1}{4\pi}$ th part of the total flux of light emitted by a source having a mean spherical intensity of 1 cp. A hefner-lumen is 0.90 lumen.

346. *The Efficiency of Electric Lamps* is properly stated in mean spherical candle-power per watt, and preferably in lumens per watt, at lamp terminals.

Upon the combined suggestion of Messrs. G. F. Sever, G. S.

Dunn and C. P. Steinmetz it was decided to submit the amendments to the membership for comments or approval by letter not later than Aug. 1 in order that the rules may be printed in the fall.

#### Massachusetts Commission News.

The Massachusetts Railroad Commission gave a hearing on July 8 on the petition of residents of Revere for a reduction from 10 to 5 cents in the fare between Revere and Lynn, on the lines of the Boston & Northern Street Railway Company. Town Solicitor Cutler, of Revere, conducted the case for the petitioners, and urged that as the fare between the two municipalities on the company's main line is 5 cents, the same charge should be in effect between points on branch lines and the termini: in other words, the petitioners desired the company to issue free transfers to and from its main line in Revere. In connection with the petition Channing Howard, town engineer of Revere, advocated the construction of a loop line on Ocean Avenue, Revere, to facilitate the handling of the beach traffic. For the company, Bentley W. Warren, Boston, opposed the construction of a loop, stating that it would cost at least \$20,000, and maintained that the company cannot afford to establish a 5-cent fare between points on the branch lines and Lynn. If an exception should be made in one case, other neighborhoods served by branch lines would have an equal right to demand the same charge and the results would be disastrous to the company's revenue. Mr. Warren said that already the company is handling considerable traffic at a loss in Revere, and offered to submit any figures that the commission might desire to prove the inability of the company to grant the transfer privilege. The board closed the hearing and took the case under advisement.

The Railroad Commission has recommended that the Boston & Northern Street Railway Company construct a double track in Malden Street, Saugus, as petitioned by citizens of the above town. The finding of the board points out that the present single-track facilities are inadequate for the traffic handled.

The Massachusetts Railroad Commission has approved the plans of the Boston Elevated Railway Company for the construction of an elevated station in Causeway Street, Boston, between Haverhill and Portland Streets, and adjacent to the North Union Station of the Boston & Maine Railroad. The new station will be used by surface cars entering and leaving Boston by the East Cambridge elevated structure over the Charles River dam, and also by Atlantic Avenue shuttle elevated trains connection to the North and South stations. The new station will be provided with a platform 235 ft. long and from 8 ft. to 17 ft. wide for subway cars entering Boston, and a combined surface car and elevated train platform 410 ft. long and from 8 ft. to 17 ft. wide, with passageways to the North Station and street. A noteworthy feature of the design is the location of entrances and exits on but one side of the street, a physical connection also being provided to the North Elevated Station.

The Massachusetts Gas & Electric Light Commission gave a hearing on July 13 upon the petition of the Pittsfield Electric Company for authority to issue 2250 shares of additional capital stock of the par value of \$225,000, for the purpose of paying indebtedness and providing for the cost of further extensions of its plant. President Alexander Kennedy appeared on behalf of the company, with William L. Adam, and W. A. Whittlesey, superintendent. Mr. Kennedy stated that the company desires to raise money to supply additional facilities for the generation and distribution of electricity. The territory which it serves is growing so fast that in some cases desirable business has had to be refused on account of the inadequacy of the present plant, which has no margin of power. The company has two plants, one being on Renne Avenue, Pittsfield, and the other at Silver Lake. Mr. Kennedy stated that the Renne Avenue station, which is a non-condensing steam plant with a heating load in winter, is now carrying practically the entire load of the company. Several years ago the com-

pany built an oil engine station at Silver Lake, but while this station has met the requirements of good economy, it has been decided to expand no further in this direction on account of the absence of service reliability of the oil engine installation, which has been shut down for two months for repairs. The company was obliged to purchase energy from Dalton and from the Van Cickler Mills, in order to fulfill its obligations.

Superintendent Whittlesey stated that the cost of the improvements was based upon the erection of a 750-kw steam turbine plant at Silver Lake at an estimated expense of about \$137,111, and upon improvements in lines, transformers, meters, motors and underground construction, which total \$45,000. Among the detail items of cost are: Steam turbine, 750 kw, \$12,500; chimney, \$4,000; boilers and superheaters, \$15,000; building, \$25,000; piping, \$7,500; piling under building, \$3,000; auxiliaries, \$5,000; switchboard and tie line equipment, \$6,000; coal and ash handling apparatus, \$2,500; steel work, \$13,000; and engineering, \$11,000. Within two years the company will expend \$17,000 on its lines, and \$5,000 will be applied to the transfer of the lines to Dalton to its own poles, these now being carried on the right of way of the Berkshire Street Railway Company.

Mr. Adam stated that the company employed the Stone & Webster Engineering Corporation of Boston a few months ago to make a thorough study of its power situation and to recommend a line of development for the future. The results of this investigation showed the necessity of building a new plant at Silver Lake, the initial capacity to be 750 kw, and the additions to begin with a 1000-kw unit. Stone & Webster reported that it would be possible by spending a moderate sum upon the old steam plant to operate the system for about three years, but it was considered more advisable to cut loose from the old equipment and start the erection of a modern steam station of the turbine type which could be relied upon to meet the conditions better in the long run. At Silver Lake water can be had free of charge for condensing purposes, and in the long run the least expensive plan is to spend the larger sum at the outset. With the new plant the company can supply points in the city which are not now readily served. The station economy of the turbine installation will improve with time, as the new plant absorbs more and more of the load and as the older steam and oil engine equipment is superseded.

Concluding, President Kennedy said that the directors had fixed the price of the new stock at \$120 per share. The company has been paying 8 per cent dividends, so that the return upon the new stock at this price amounts to 6½ per cent, or only a little more than the legal rate of interest. Chairman Barker stated that the company's presentation bespoke a conservative attitude regarding capital and dividend requirements. The Board then took the case under advisement.

#### Maryland Commission News.

The American Telegraph & Telephone Company last week filed an application with the Maryland Public Service Commission for permission to lay its wires underground along the boulevard between Baltimore and Washington. The State Roads Commission has already granted the company permission to use the boulevard for this purpose.

After permission had been granted by the Court for Messrs. James M. Ambler, Philip D. Laird and Joshua W. Herring, constituting the Public Utilities Commission, to intervene in the suit of the Auxiliary Realty Company to restrain the Mayor and City Council from paying parts of the commissioner's salaries, a demurer to the bill of complaint was filed by the commissioners. Admitting all of the statements made in the bill of complaint, it is contended in the demurrer that the company has not stated such a case as entitles it to the injunction it asks. Mr. W. Cabell Bruce, general counsel to the commission appeared for the commissioners in the proceeding. The suit of the Auxiliary Realty Company is to enjoin the City of Baltimore for paying \$3,000 a year to Chairman Ambler and \$2,500 a year to each of the other two commissioners, as

is stipulated by the Public Service Commission law. It is contended in the bill of complaint that this provision was inserted in the act to evade the requirement of the State Constitution limiting the salaries of all State officials to \$3,000 a year except when otherwise provided. In their petition for authority to intervene in the case, the commissioners state that the act creating the commission requires its general counsel to appear for it in all proceedings involving any question under this act. The suit of the Realty Company, this also states, involves the validity of the section of the act requiring the city to pay a part of the salary of the commissioners. An order authorizing the commissioners to intervene in the case was signed by Judge Stump.

The commission considered a complaint last week relating to the service of the United Railways & Electric Company of Baltimore. The fare between Baltimore and Ellicott City is 15 cents. The petitioners point out that the fare between Baltimore and Catonsville to residents of the latter place is only 7½ cents. Another protest was registered against the company alleging that the cars on one of its lines are too frequently dangerously overcrowded. The commission is also investigating a protest against the rates for electricity charged by the Mount Washington Electric Light & Power Company. The company has a minimum rate of one dollar a month, whether or not that quantity of electricity has been used. The complainant says that this part of the contract which the consumer must sign with the company, is highly unjust.

#### New York Commission News.

From public expressions and from letters written by Chairman Willcox, of the Public Service Commission of the First District, to Mayor Gaynor, it became evident last week that the most recent proposal of the Interborough Rapid Transit Company for the construction of subway extensions would not find favor with the commission. The matter has not been officially considered by the commission as yet, but the unofficial expressions have been very definite. In view of this situation, President Shonts of the Interborough has written a letter to Mayor Gaynor in which he modifies the proposal to the extent of expressing his willingness to abandon the Lexington Avenue route and build a line under Madison Avenue, and also to modify his proposal that the city should stand the loss during the first, unremunerative years of operation. These modifications have not yet been officially presented to the commission.

The Public Service Commission last week granted the application of the Manhattan Bridge Three Cent Line for a certificate of public convenience and necessity, authorizing it to run trolley cars between the Long Island Railroad station at Atlantic and Flatbush Avenues, Brooklyn, to the Desbrosses Street Ferry terminal on West Street, Manhattan. The line will cross the East River on the Manhattan Bridge, but as yet the route across Manhattan has not been definitely settled. It was proposed at first to use the existing tracks in Canal Street under a leasing arrangement, but such an arrangement has not been made. The franchise for this road has already been granted by the Board of Estimate and Apportionment.

The commission last week definitely closed the hearings upon the Third Avenue Railroad reorganization plan. These hearings were begun last December and a vast amount of testimony has been taken. At the final hearing Mr. D. G. Connette, transportation engineer of the commission, gave his final estimate of the value of the property on Feb. 28, 1910, as \$31,666,224. It is thought that a decision in this case will soon be rendered, and it is believed that the reorganization plan will be sanctioned with some important modifications.

The commission last week adopted a resolution laying out a rapid transit route in Utica Avenue, Brooklyn, south from the Eastern Parkway to a point in Flatbush Avenue near Jamaica Bay. It is proposed to construct this route upon the assessment plan. It is the first line on which the commission has taken action under this plan.

At the request of the Interborough Rapid Transit Company,

the commission last week suspended for 30 days the order it issued last April directing the running of subway trains on a two and a half minutes headway. This was done because General Manager Hedley of the company reported that during the summer months the travel in the subway decreased about 25 per cent.

The Public Service Commission last week voted to advertise for bids for the construction of the proposed Tri-borough subway within the next few weeks. Two forms of construction will be advertised; one for private construction and equipment and another for municipal construction and private equipment. The bids will be opened on either Sept. 13 or Sept. 20.

The commission approved last week an agreement submitted by the Tunnel & Terminal Railroad Company, which owns the Pennsylvania tunnel and terminal, and the Pennsylvania Railroad Company, whereby the latter acquires the right to operate the tunnels under the North and East Rivers. The council for the two companies stated that before next March a permanent agreement would be made and submitted to the stockholders of the Pennsylvania Railroad Company. This will involve the formal taking over of the terminal property.

At the hearing last week into the price of gas and electricity charged by the Queens Borough Gas & Electric Company, Mr. Eugene D. Hawkins, attorney for the company, asked for an adjournment, and the case was postponed until Sept. 29. This investigation was brought on the complaint of 100 consumers and has been deferred from time to time for several months. Mr. Hawkins stated, in asking for the postponement, that experts were now going over the books and engineers are studying the properties of the company with a view to establishing their exact value in order to form a basis to justify the claim that the present rates were reasonable. This work he said could not be completed until the latter part of September. Mr. Hawkins also filed in evidence the certificate of incorporation of the company, copies of its mortgages and of the franchises under which it does business.

#### EXTENSION OF DISTRIBUTING CIRCUITS.

The Public Service Commission, Second District, has made several important rulings defining the commission's powers in the matter of requiring gas companies to extend their gas mains under the streets and establishing principles to be observed by gas corporations in charging consumers for the cost of such construction in part or in whole and in connecting consumers' premises with the service. The ruling presumably also has a bearing on electrical extensions.

In cases where the gas main is already in the street upon which the premises to be supplied are located and where the premises are situated within 100 ft. of the main, the commission ruled that the following division of expenses is reasonable and proper: That the gas company assume the cost of the pipe and the expense of laying the same from the main to the curb and compel the consumer to pay the expense of running the pipe from the curb to the meter.

In cases where the main is already in the street and the premises to be supplied are situated more than 100 ft. from the main, and in cases where the main is not in the street or has not been brought up to a point therein where it is within 100 ft. of the premises sought to be supplied, the commission points out that its powers as amended by the Legislature of this year are ample to require extensions of mains a distance of more than 100 ft., but the commission will exercise its discretion as to the reasonableness of ordering such extension or exercising such large powers.

As to whether a company should discriminate in furnishing service to premises which are wired for electricity at the time of making the application, the commission rules that the company should charge all consumers for curb-to-house services and must desist from the practice of installing service pipes from curb lines to houses free of charge in cases where consumers' houses are not wired for electricity and where the consumer obviously expects to use gas exclusively. The commission also rules that the cost of such installations may be graded or apportioned on the basis of gas consumed or to be consumed.

Should the charge for installation be arbitrary and uniform per foot or be governed by the actual cost of performing the installation of the service, the commission rules that if any charge is to be made at all for installing the service pipe from the curb to the house, it should be made at the actual cost of the work. If an arbitrary charge per running foot proves satisfactory, both to the consumer and to the company, such charge may be made, but the right is reserved to the consumer to demand the bill for the actual cost of the work.

The Public Service Commission, Second District, will hold hearings during the coming week on the application of the Livingston-Niagara Power Company for permission to begin construction and approval of the exercise of franchises in Livingston county and for authority to execute a mortgage upon its properties for \$350,000 and to issue an equal amount of bonds and \$100,000 of common capital stock; and on the answer of the Homer and Cortland Gas Light Company in an order to show cause why it has not carried out the direction of the commission as to the disposition of the proceeds of its bonds which the commission authorized.

The Public Service Commission, Second District has authorized the Mohawk Hydroelectric Company to execute a mortgage upon all its property and franchises to secure the issue of 6 per cent 30-year bonds to the amount of \$3,000,000. The company is also authorized to issue its capital stock, \$100,000 preferred and \$575,000 common stock, and its bonds secured by the mortgage to the amount par value of \$932,000, bonds to be sold at not less than 88. The proceeds of the sale of stock and bonds are to be used for the payment of lands and water rights on Peck and Garoga Lakes and along Garoga Creek, for traveling expenses, engineering fees, services of promoters and bankers, the construction of dams, pipe line, power house, machinery, excavation, clearing of flood lands and sundry organization expenses.

The Cayadutta Generating Company has been authorized to take over the right, title and interest in certain franchises granted by the village of Fultonville, town of Mohawk, Montgomery county, and the village of Fonda, to Adam Z. Temple and J. S. Wilson, for the construction and maintenance of electric lighting systems within the boundaries of the localities mentioned. The Cayadutta Generating Company is authorized to exercise the rights and privileges granted in the franchises and to construct, lay down and maintain suitable conduits and other conductors and fixtures in the villages of Fonda and Fultonville. The company is authorized to buy the property and to issue \$30,000 of its common capital stock for the purpose of purchasing the property in question, and is also authorized to issue and deliver to the Schenectady Trust Company a first consolidated and refunding mortgage to secure an issue of 5 per cent 30-year gold bonds to the amount of \$30,000 and to issue bonds to the full amount of the mortgage. It is provided that the bonds shall not be sold or disposed of at less than 90.

The commission has received a complaint from the A. L. Swett Electric Light & Power Company, directed against the Middleport Gas & Electric Company, alleging unlawful exercise of franchises in the town of Rayalton. The complainant company holds a franchise in the town in question and consent has also been given to the Middleport Gas & Electric Company. The latter named company, however, has not received the consent of the Public Service Commission, Second District, to the exercise of its franchises. The complaint has been served upon the Middleport company and an answer asked for within 20 days.

An order issued by the commission allows the Palmyra Gas & Electric Company, Newark Gas Light & Fuel Company, the New Light, Heat & Power Company, Lyons Gas Light Company and the Wayne County Electric Company to consolidate into the Wayne County Gas & Electric Company. In approving of this consolidation the commission has required that the capital stock of the Wayne County Gas & Electric Company shall be \$200,000, which is \$45,000 less than the sum of the capital stock of the corporations consolidated; that by means

of the surrender of capital stock and charging off surplus, the fixed capital account of the consolidated company will be credited with the sum of \$56,700.65; the obligations of the constituent companies, aggregating \$13,054.52 shall be cancelled, thus reducing the amount of obligations to be assumed by the new company. The new company has assented to all these conditions.

The New Light, Heat & Power Company, of Newark, N. Y., has been authorized to exercise franchises and erect and maintain a plant for electric lighting, power, etc., in the town of Arcadia, Wayne County. The Palmyra Gas & Electric Company has been authorized to exercise franchises and to construct and equip a plant for furnishing and distributing gas and electricity in the town of Palmyra, Wayne County. The Newark Gas Light & Fuel Company has been authorized to exercise franchises and to construct a plant for the furnishing and distribution of gas for light, heat and power in the town of Arcadia, Wayne County.

A petition has been received from the Olean Electric Light & Power Company for authority to issue \$50,000 common capital stock to pay for additions, extensions and improvements to its plant, already made and the completion of others under way.

The Public Service Commission, Second District, has authorized the Mohawk Hydroelectric Company to construct a hydroelectric plant on and along Garoga Creek, Fulton County, for generating electrical energy, and also to exercise rights and privileges under a franchise granted by the Town Board and superintendent of highways of the town of Ephratah, Fulton County. A considerable portion of the electrical energy developed will be sold generally for light, heat and power purposes through the Fulton County Gas & Electric Company. The Fulton County Gas & Electric Company has employed a hydraulic engineer to examine into and investigate the hydraulic features of the proposed water-power development and is satisfied with the ability of the company to carry out the terms of an agreement made. Mr. Walter McCulloch, consulting engineer of the State Water Supply Commission, has also made a report to the Public Service Commission, in which he states that the drainage area and plan of water storage is adequate to develop an amount of electrical power claimed by the applicant; that the proposed hydroelectric development is a feasible engineering proposition; and the cost of the proposed development as estimated by the applicant is not unreasonable.

The commission has ordered a hearing to be held at its Albany office on Sept. 7 to which all gas and electrical corporations in the second district are invited, and where will be discussed the proposition of requiring every gas corporation and electrical corporation and municipality to file with the commission and to print and keep open to public inspection schedules showing all rates and charges made, established or enforced, or to be charged or enforced, all forms of contract and agreement; all rules or regulations relating to rates, charges or service used or to be used; all general privileges and facilities granted or allowed by gas or electrical corporations or municipalities, and prescribing the form of every such schedule; and the further matter of establishing rules and regulations to carry into effect the amended provisions of the law in this respect as changed by this year's Legislature.

#### Metallic Filaments for Incandescent Lamps.

A patent was granted July 12 to Dr. W. D. Coolidge, of Schenectady, on an application filed Aug. 1, 1906, on a process for making metallic filaments for incandescent lamps. According to the invention, a refractory material is incorporated in a colloidal solution to produce a pasty mass, and this mass is squirted or otherwise shaped to form threads, filaments, rods, or other desired shapes; these bodies are then treated to remove all easily vaporizable components and yield a conductor of refractory material suitable for use in incandescent lamps and other apparatus. As a basis for the refractory conductor,

various metals or elements may be used, such as tungsten, molybdenum, boron, zirconium, titanium, thorium, etc.

Colloidal solutions suitable for use as binding agents are easily produced by well-known chemical methods, such as the Carey Lea method, or may be produced by various methods which yield a pasty and sticky mass though preferably the colloid should be one which can be changed to the metallic state without any special difficulty. Colloidal silver is very easily made and is entirely satisfactory, though colloidal gold is also suitable, as are also colloidal copper and many other metals of relatively high melting point.

The finely divided refractory material may be incorporated in the colloid by simply stirring it in and mixing thoroughly. If silver colloid is used as the binding means and tungsten as the refractory element, it is preferable to have the tungsten in a finely divided condition. This state is easily obtained with tungsten, and in fact with most of the elements above enumerated, for the reason that they are ordinarily obtained as fine powder which may be ground, sifted, or precipitated to separate out the coarse grains and leave a homogeneous residue of exceeding fineness. In adding the tungsten to the silver colloid it is preferable to put in as much tungsten as the colloid will take and still retain the sticky qualities necessary to an easy manipulation of the product. It is probable that the colloid does not chemically unite with the tungsten, but acts more as a suspending medium to take up the exceedingly fine particles of tungsten and to hold them in position by capillary or other forces.

After obtaining threads or filaments of the desired size and shape, and then drying to drive out any excess moisture, they are treated to convert the colloidal metal into the metallic state. This may be conveniently done by chemical methods, as by subjecting the colloid to the action of electrolytes or to the precipitating action of acid fumes. For instance, traces of HCl vapor may be blown over the threads of tungsten and silver colloid and thereby instantly convert the silver into the metallic state in which condition it acts as a firm binding agent for the tungsten particles. The wires or conductors produced as above described have sufficient ductility to permit ready manipulation and mounting on lead-wires. Some of the impregnated colloid may be used as a paste for securing the threads to the lead-wires. The ductile metal, as for instance, silver, gives the wire strength, while the refractory powder with which the silver is impregnated is in sufficient quantity to insure a continuous wire after the silver is removed. The next process is to drive the ductile or low melting metal out of the wire and the pasted joint, and consolidate the refractory powder into a coherent conductor suitable for operation at high temperatures. This may be conveniently done by passing current through the threads or filaments in a vacuum or in an inert atmosphere and thereby vaporizing the silver and sintering the tungsten particles together. The silver comes out entirely and the particles of tungsten draw together and consolidate into a strong wire. Capillary forces are very strong with metals which melt at high temperatures, and this phenomenon assists in producing a coherent product.

#### Silicon-Carbon Incandescent Lamp Filaments.

A patent for which application was filed April 5, 1906, was issued on July 12 to Mr. Walter G. Clark on a process for making incandescent lamp filaments. The object of the invention is to coat a filament with silica so as to prevent any ionization of the filament or any deterioration by reason of its throwing off emanations. By coating the filament with silica, no emanations can be thrown off and the lamp globe is kept clean. This is desirable because the ordinary temperature of incandescence is not sufficient to melt the silica. To this end silicon is deposited on a carbon filament by a method on which the same inventor was granted two patents dated Jan. 14, 1908; that is, the carbon filament is flashed in an atmosphere containing tetrachloride of silicon, a hydrocarbon gas, and ole-

fiant gas which serves as an absorbent for the chlorine freed by the flashing process; and after the silicon surface begins to appear and while the silicon is being deposited, a little oxygen is admitted into the presence of the filament and the silicon surface will thus be oxidized sufficiently to convert it into silica. Only a very little oxygen is needed, and by regulating the amount, the oxidation can be carried inward to the necessary extent so that in this way the silica coating can be regulated.

#### Commutation.

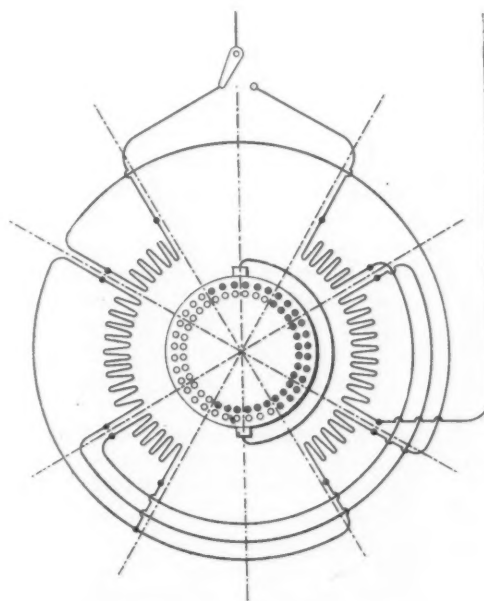
A patent, for which the application was filed in 1902, was issued to Mr. W. E. Goldsborough on March 22. The inventor proposes to improve commutation by the insertion of impedance coils in the commutator leads, these coils to be brought into inductive relation with a stationary short-circuited coil during the period of commutation.

#### Single-Phase Commutator Motor.

A patent issued to Mr. W. A. Layman covers an improvement in the Wagner-type single-phase motor. The rotor is provided with two windings and two commutators. When starting the brushes on the main winding are short-circuited in the usual way and those of the auxiliary winding are connected in series with the main field winding. When up to speed the main rotor winding is short-circuited and an auxiliary compensating winding on the stator is connected in shunt with the auxiliary rotor winding. The purpose of these auxiliary windings is to improve the starting torque and improve the power factor, both at start and when running.

#### Single-Phase Commutator Motor.

A motor of the repulsion type in which the motor field is produced by ampere turns on the rotor is the subject of a patent issued to Mr. V. A. Fynn. The rotor is provided with a fractional-pitch winding in order to neutralize the ampere turns in

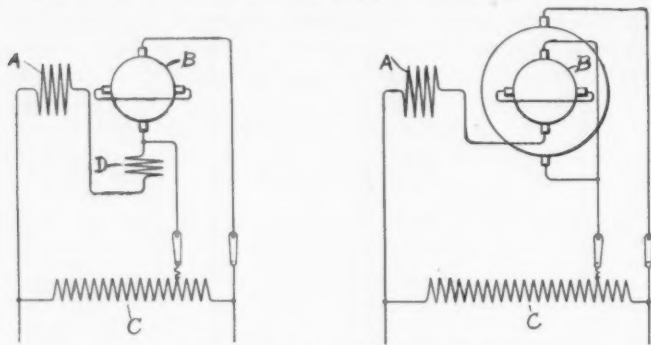


Fynn Single-Phase Commutator Motor.

the commutation belt. The stator winding is made up of three sections, as shown in the illustration. The large section is used to neutralize the ampere turns in the corresponding belt on the rotor, and the other two sections determine the direction of rotation, only one being in circuit at a time.

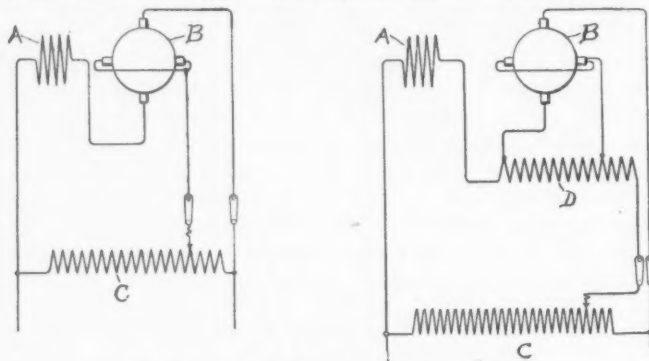
### Series Repulsion Motors.

A patent issued to Mr. Friedrich Eichberg aims to improve the efficiency, power-factor and speed torque characteristics of the Winter-Eichberg type of single-phase commutator motor by



Figs. 1 and 2—Series Repulsion Motors.

introducing a series excitation superposed upon shunt excitation. Figs. 1 to 4 show several different connections used to accomplish this result. In the illustrations *A* is the inducing winding, *B* the rotor winding, *C* a transformer and *D* a winding on the



Figs. 3 and 4—Series Repulsion Motors.

stator adapted to produce a magnetization assisting that produced by the circuit between the excitation brushes.

## CURRENT NEWS AND NOTES.

**Plans for New York Docks.**—New York Dock Commissioner Tompkins has prepared plans for the establishment of a \$100,000,000 municipal joint electric railway freight terminal on the North River in Manhattan. The proposal for the new terminals will be put before the Board of Estimate in the fall.

**Chicago Meeting of A. E. S.**—The American Electrochemical Society will hold its next general meeting in Chicago from Oct. 13 to 15. The selection of Chicago as the meeting place was brought about by the recently organized Chicago Section of the society, of which Prof. H. N. McCoy, of the University of Chicago, is chairman, and Mr. Arba B. Marvin is secretary-treasurer. The Wisconsin Section of the society will co-operate in the arrangements for the meeting.

**Steam-Electric Locomotive.**—A type of portable isolated plant electric locomotive was tested in Glasgow, Scotland, on July 14. The locomotive is propelled by four electric motors which receive energy from a steam turbo-generator, the generating and propelling equipments being self-contained. The advantage claimed for the type over the steam locomotive is economy in fuel. In comparison with the usual electric locomotive, it is said to be more economical in cost of installation and maintenance.

**Telegraphy in Spain.**—Wireless telegraphy is a government monopoly in Spain, but a concession for the installation

of the equipments and operation of the stations has been granted to a private concern by the Bureau of Posts and Telegraphs. The bureau operates a total of 3830 miles of wire telegraph lines and had in its employ for this service 4811 persons in 1908. During this year the total receipts were \$1,835,227 and the expenditures \$1,955,414; the excess of expenditures was, therefore, \$120,187.

**Coal Land Withdrawals.**—Including some land withdrawn on July 14, the amount of coal land withdrawn by President Taft from entry to date totals 71,518,588 acres, having an appraised value of \$449,876,208. The tracts are located as follows: Arizona, 161,280 acres; Colorado, 6,151,161; Montana, 20,208,865; New Mexico, 2,944,279; North Dakota, 17,828,162; Oregon, 192,562; South Dakota, 2,870,287; Utah, 5,814,287; Washington, 2,207,967, and Wyoming, 13,099,718. All of this land is open to agricultural entry with a limited surface patent.

**Japanese Water-Power Plan.**—A new policy has been adopted in Japan in connection with the multitude of concessions for hydroelectric plants. For some years there had been a mania for obtaining these franchises, and applications were granted for almost every Japanese river on which a town of 50,000 was situated. Many of the concessionaires proved to be speculators without any idea of carrying on the work. The Tokio Government now has instructed local officials that a time must be fixed within which these concessionaires must get to work or forfeit their rights.

**Fuel Testing.**—The new Bureau of Mines is given cognizance of testing and analyzing coals, lignites and other mineral fuel substances, belonging to, or for the use of, the Government. Of \$100,000 appropriated for this work, \$35,000 will be spent in chemical and physical investigation of fuels; \$25,000 in the inspection of Government fuel purchases; \$22,000 in fuel efficiency investigations; \$5,000 in lignite and peat investigations, and \$4,000 in briquetting investigations. Among publications of the new bureau now under preparation are the following: Volatile matter in coal; coal analyses; producer-gas tests; petroleum for combustion under steam boilers; final data regarding steam tests; North Dakota lignite as a boiler fuel.

**Kansas City Office Building and Substation.**—An important addition to the main office building of the Kansas City (Mo.) Railway & Light Company, at Grand Avenue and Fifteenth Streets, is rapidly nearing completion. It is built of brick and is five stories high, with ground dimensions of 84 ft. x 110 ft. The first floor will be devoted to a large substation, while the upper stories will be divided into offices, to supplement the office space in the older portion of the building. The lighting side of the substation will contain a 1500-kw rotary converter, a 700-kw booster, a 500-kw motor-generator set and a 3000-amp-hour storage battery. In the railway portion there will be five machines, consisting of a 2000-kw rotary, a 1500-kw rotary and three rotaries rated at 1000 kw each.

**Northern Indiana Interurban to Sell Electricity.**—A Michigan City press dispatch, dated July 13, states that the Chicago, Lake Shore & South Bend Railway Company will supply electricity for all purposes in all cities along its line, and that officers of the company are now investigating the franchises under which the electric companies are operating in these cities. The large plant of the company at Michigan City is being enlarged with additional equipment valued at \$140,000, and it is believed, apparently, there will be a surplus of electrical energy which the company would like to dispose of to commercial consumers. The modern single-phase interurban railway operated by the company extends from Pullman, Ill., to South Bend, Ind., and passes through Hammond, Indian Harbor, East Chicago, Gary, Michigan City and New Carlisle, Ind.

**New Haven Electrification.**—According to a statement credited to Judge A. Heaton Robertson, a director of the New York, New Haven & Hartford Railroad the electrification of the line from Stamford to New Haven is being held up because of the continued agitation in Connecticut for a public utilities commission. The work would cost about \$10,000,000, including a new passenger station at New Haven.

**Tests of Structural Materials.**—The new Bureau of Mines authorized by the recent act of Congress came into existence July 1. The bill establishing the bureau as originally approved placed under this bureau structural material investigation, but the Sundry Civil appropriation passed as Congress was about to adjourn amended the law placing cognizance of this subject with the Bureau of Standards, including an appropriation for personnel and equipment.

**Maine Electric Association.**—The annual meeting of the Maine Electric Association will be held at Portland, Maine, Thursday and Friday, July 28 and 29. On Thursday there will be a dinner at Cottage City, and on Friday a sail down Casco Bay to South Harpswell, where there will be sports and a clambake. Several interesting papers and discussions are promised for the meeting. Mr. F. D. Gordon, of Lewiston, is secretary.

**Steam Road in Southwestern New York Seeks Electrification.**—The Jamestown, Chautauqua & Lake Erie Railroad Company has made application to the Public Service Commission of the Second District of the State of New York for permission to electrify its line, which extends between Jamestown and Westfield, N. Y., a distance of about 28 miles. This railroad has been operated by steam locomotives and undoubtedly the freight traffic will continue to be handled in this manner. The road connects with the Buffalo & Lake Erie Traction Company's line at Westfield, and no doubt, like that system, of which it is really a part, electrical operation will be obtained by the use of energy from Niagara Falls.

**Consolidated Traction Reorganization in Chicago.**—In the proceedings growing out of the effort to amalgamate the Chicago Consolidated Traction Company and the Chicago Railways Company of Chicago, Judge Grosscup has taken up the question at issue between the bondholders of the old Cicero & Proviso Street Railway Company and the consolidation committee. The bondholders are contending for a more liberal distribution of Chicago Railways securities than was offered for their property. Judge Grosscup is sitting as arbitrator, and with him, as advisers, are Mr. Calvin Goodrich, president of the Twin Cities Rapid Transit Company, of Minneapolis, and Mr. George G. Moore, financial director of the Michigan United Railways.

**New Substations for Commonwealth Edison System.**—The Commonwealth Edison Company of Chicago is just completing its new Edgewater transformer substation which is expected to go into operation by Aug. 15. This station supplies energy from the 12,000-volt transmission system to a North Shore residential section, and is in general similar to the new Troy Street substation which was put into service recently. Like the Troy Street station the new substation is located about seven miles from the Fisk Street generating plant. The company is also demolishing and rebuilding its substation at the corner of Twelfth and State Streets, where it is preparing to install six split-pole rotaries, several of which will go in at once. The new State Street substation will be completed about Nov. 1.

**An Electric Railway Theater.**—Electricity is employed in a number of ways at the new theater of the Boston Suburban Electric Companies at Norumbega Park, Mass., which was opened in May of the present year. The theater was built at a cost of \$60,000, and seats 3500 persons. Among the appli-

cations of electricity are the lighting of the stage, borders, foots, and auditorium, illumination of green, dressing and property rooms, operation of a baggage hoist, and supply of energy for moving picture machines and stereopticons. Lamp signals are used to a considerable degree about the stage, and ornamental lighting is installed in outside corridors to attract attention to the performances from outside the theater structure. A 2½-hp motor is installed for the operation of an 800-lb. baggage hoist at the rear of the stage. Buzzer signals are installed at various points, and a complete interior telephone service is in operation. The auditorium is lighted by enclosed arc lamps supplied with energy from the railway circuits. The proscenium, border and footlights are mainly 32-cp units, frosted lamps being extensively used in the borders.

**One "Side Issue" in Planning a Big Generating Station.**—Work on the proposed new generating station of the Commonwealth Edison Company of Chicago, on North California Avenue (extended) and the North Branch of the Chicago River, recently described in the *Electrical World*, has been delayed owing to arrangements with the city authorities for a switch-track railroad connection. This is the generating station which is to be equipped with 20,000-kw turbo-alternators and which will be known as "Northwest" station. The switch-track, which will be about 4000 ft. long, is to connect the powerhouse site with the tracks of the Chicago & Northwestern Railway, and there have been protracted negotiations with the owners of adjoining property in relation to it. The company has offered to elevate the track, provide subways at all street and alley intersections, maintain a 125-ft. right-of-way and to limit the freight carried to its own material and supplies. After the station or stations (for the ultimate plans contemplate two 120,000-kw stations) are built, the spur will be used principally, no doubt, for the transportation of coal and other central-station supplies. The City Council committee on local industries has had the proposed ordinance under consideration and has been very careful to safeguard the interests of the property owners. It is said that, taking into account the awards for damages to property and the cost of the right-of-way and the railroad itself, the total cost for this switch-track will be between \$150,000 and \$200,000. After careful consideration the ordinance has been recommended by the local industries committee and doubtless will be passed by the City Council.

**Electrically Operated Score Board in Ball Parks.**—Enthusiastic "fans" watching games in Chicago and other cities have their pleasure enhanced by an electric score board which "keeps tab" on many of the plays. In Chicago these devices are in place in both the National and American League parks. They show directly the number of "balls," strikes, outs, etc., in figures 20 in. high, all controlled from a keyboard in the press box. The figures are painted on black disks pivoted behind windows in the black scoreboard, and controlled by electromagnets so that the disks roll over through 180 degrees, when the corresponding button is pushed. In this way the first closure of the circuit serves to display the figure, and a second clears it out, bringing the blank side of the disk again opposite the window. The electromagnets are energized by a battery of dry cells, and merely release the disks, which are turned by weights. The score boards installed in Chicago give the number of balls, number of strikes, number of men out, and figures designating the names of the man at bat, the pitchers, catchers and umpires—a key to these numbers being given in the scorecards. The keyboard at the West Side park has 23 buttons, and is also equipped with a telephone for communicating with the man at the scoreboard who hangs up the figures for the innings of the local and other games. As the electromagnetically operated plates are limited to showing in separate spaces for each figure, they could not be conveniently applied to the uses of the ordinary score-by-innings board. The Chicago National baseball park electric scoreboard is the nucleus of a steel-and-concrete advertising display, 300 ft. long and 50 ft. high, which cost \$17,000 to erect.

**Heat-Unit Gas for St. Louis.**—The Laclede Gas Light Company, St. Louis, has requested the passage of a municipal ordinance to change the basis of measurement from a candle-power to a heat-unit charge. The claim is that the illuminating value is of secondary importance to the heating value of the gas.

**Electric Stimulus to Plant Growth.**—Following some of the experiments which have been conducted in Germany, England and elsewhere, ex-Judge Thomas H. Williams, of Brooklyn, is installing an equipment for applying electricity to the soil for the purpose of accelerating the growth of plants and vegetables. A two-acre plot has been set aside for the tests, which will be started about Aug. 1.

**Bonus for Employees.**—As a reward for continuous service the Capital Traction Company, Washington, D. C., has given \$18,000 to 280 of its conductors and motormen. The awards were divided into three classes. To those who had been in the service of the company for 10 years or more, with good records, \$100 was given; to those with a five-year record, \$50, and to the three-year men, \$25.

**Accident to Monorail.**—On account of the weakness in the supporting structure, the cigar-shaped car of the Pelham Bay Park & City Island Monorail Company left its track near City Island, N. Y., on July 16, injuring about 20 passengers of the 100 who had packed the car for a ride on its first passenger-carrying trip. Haste in erecting the track-way in order to comply with the terms of the Board of Estimate's franchise, is given as an explanation of the weakness which resulted in the derailment of the car.

**Compulsory Wireless for Vessels from British Ports.**—Following the lead of the United States, England is preparing to pass a bill making compulsory the equipping with wireless systems of all passenger vessels which sail from its ports. A bill covering this ruling has been introduced in the House of Commons by Sir Edward Sasson. It calls for an installation on each vessel capable of receiving and transmitting a distance of 100 miles. A penalty of \$5,000 in the event of failure to obey the law is provided.

**Cleveland's Three-Cent Fare.**—A deficit of \$78,828 has been declared by the Cleveland Street Railway Company after four months' operation under the 3-cent fare rule. The report of the company for the month of June shows a deficit of \$48,927. The directors passed a resolution to borrow \$250,000 to meet pressing obligations. The street railway system was lifted out of a two-year receivership on March 1 and handed back to the original company to be operated on a 3-cent fare basis. A profit was shown on the first month, but since then there has been a steadily growing deficit.

**Pupin Cable Across English Channel.**—A telephone cable equipped with Pupin "loading coils" for reducing the distortion of the current impulses by the capacity of the dielectric, has been placed in service successfully across the English Channel from Dover to Cape Gris Nez. The cable will be opened for public use between London and Paris as soon as the French Government has completed the connecting land lines. A note relating to this cable appeared in our issue for April 21, 1910, page 980, while certain constructive details were described on page 898 of our issue for April 7.

**Wireless Towers for the U. S. Navy.**—The United States Navy has decided to construct four wireless telegraph towers between 400 ft. and 500 ft. tall on the highest available point in the District of Columbia. The towers will be of steel, of light and graceful design, and may be copied after the wireless masts on the big battleships. The purpose of the towers will be to give the Navy Department the best opportunity possible for communicating without interruption with its ships far out at sea and with the land stations far removed. Tests recently

made by the department lead to the belief that communication with ships in the daytime 1500 miles away and at night 3000 miles distant will be possible.

**An Insect Interrupts a 52,000-Volt Transmission Service.**—The Nevada-California Power Company, which supplies electrical energy to Goldfield, Tonopah and other Nevada towns from its Bishop Creek, Cal., hydroelectric plant, was recently shut down by an insect commonly known as the "snake-feeder." The company has installed at different points on its 52,000-volt transmission system large horn-gap lightning arresters. On June 23 the large insect mentioned above flew directly between the spark gap of the arrester, with the result that it drew an arc and shut down the entire system. Upon immediate examination, the head and scorched body of the insect were found directly beneath the horn gap, with some signs of life remaining.

**Large Electrically Lighted Clock.**—Electric lighting plays an important part in the performance of the clock being installed on the United States post office, custom house and court house at Newbern, N. C. Instead of having numerals to indicate the hours, the dial is equipped with 12 opalescent glass disks which show white in the daytime and are rendered visible at night by means of light from behind directed to the disks from incandescent lamps. The hands are made of aluminum and each carries an electric lamp near the point. There is also an electric lamp at the hub of the hands. These lamps show red at night to be easily distinguished from the dial lamps. In the day the time can be read as by an ordinary clock, but at night it is read by the location of the red lamps along the illuminated dial. The clock has four dials, which can be read at a distance of two miles.

**California Electrical Contractors.**—The California State Association of Electrical Contractors held its annual convention in San Francisco from July 5 to 7. This association, which has been in existence for about a year and has a membership of about 150 firms and corporations engaged in the electrical construction business throughout California, has district and subordinate locals in San Francisco, Sacramento, Los Angeles, Santa Barbara, San Diego, Pasadena, Oakland, San José and Stockton. President W. S. Hanbridge, of San Francisco, presided. There was a steamer trip around San Francisco Bay and up the Sacramento River a short distance, and a luncheon by the Jovians at the Palace Hotel. The present officers of the association were re-elected for the ensuing year as follows: President, Mr. W. S. Hanbridge; vice-presidents, Messrs. W. B. Woddill, Los Angeles, and Charles H. Heilbroh, San Diego; secretary, Mr. F. V. Meyers, San Francisco. Los Angeles was decided upon as the meeting place for next year.

**Poulsen Wireless System in California.**—The first of a number of towers for a Poulsen wireless telegraph and telephone system has been erected on the beach at San Francisco. The tower is 300 ft. high and built of wood from a design by Prof. C. D. Loring, of Stanford University. These towers will form a part of a wireless telegraph and telephone project promoted by the Poulsen company, organized and controlled by Californians and backed largely by Stanford University men. Mr. C. F. Elwell, of Palo Alto, is the president, and the other directors are Prof. Charles D. Marx, of Stanford; Mr. J. Jerome Smith, of Stockton; Mr. R. W. Barrett, of San Francisco, and Mr. Valdemar Poulsen, of Denmark. President Elwell says his company intends to establish 480 stations for communication over the land as well as over the sea, and that when 10 of these are ready the public operation of the system will be undertaken. Los Angeles and Portland will be the next cities to have stations. He claims that the Poulsen system does not conflict with other wireless work and that the operations can be carried on without possibility of interference with others. A part of the Danish inventor's equipment is a contrivance by which, it is represented, messages can be sent by wireless telegraph at the rate of 300 words a minute.



**ELECTRICAL TRANSMISSION IN MICHIGAN.**

**Low-Head Hydroelectric Plant at Buchanan.**

**T**WO thousand horse-power is recovered from a 10-ft. fall in the St. Joseph River near Buchanan, Mich., supplying the electrical requirements of the community, and combining its surplus through transmission lines with the output of several other water-powers on the same stream to furnish electrical energy to a chain of Michigan and Indiana cities.

Buchanan is a thriving manufacturing town of 2300 people in the southwestern corner of the State of Michigan. In 1893 the village first undertook the development of its neighboring water-power on a small scale, erected a wooden dam and installed generating machinery. The municipal equipment comprised a 120-kw, 3300-volt alternator, a 50-light Thomson-Houston incandescent machine and one 50-light and one 60-

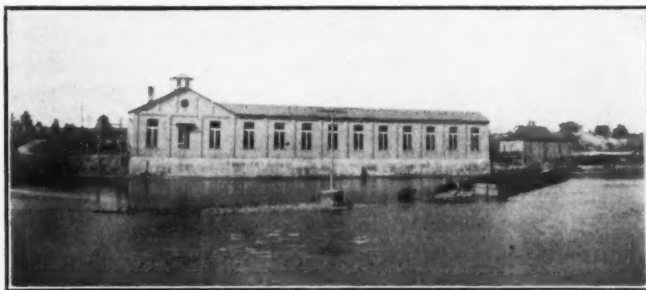


Fig. 1—Low Head 1500-Kw Water-power Plant at Buchanan, Mich.

light Standard arc machines. The full capacity of the fall was not nearly developed by this outfit, and the inadequate construction of the dam and raceway failed to inspire confidence in the individuals who acquired the water-power in exchange for a water-works system which they constructed for the town. A new plant was accordingly built in 1902 by private interests, at an expenditure of about \$500,000.

The concrete dam has a spillway 396 ft. in length, its sill creating a head of 10 ft. above the tailrace. A concrete apron extends 15 ft. below the sill and is continued by a flooring of riprap for a distance of 35 ft. When the river flow is ade-

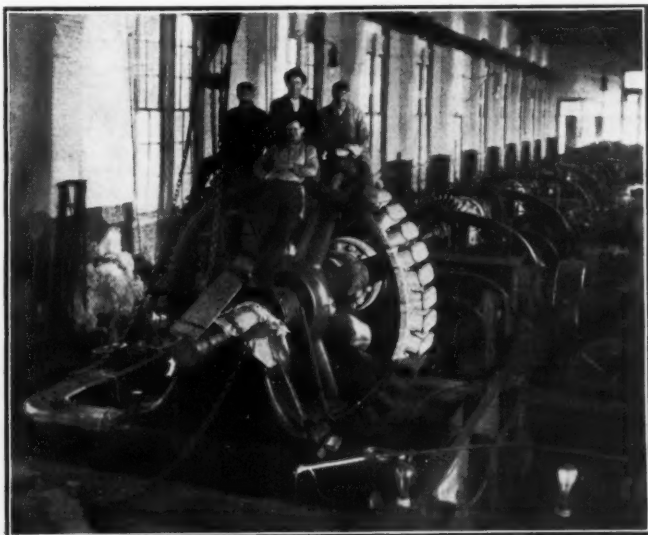


Fig. 2—View of Interior of Buchanan Station During Construction.

quate, the head of water at the dam can be increased to 12 ft. by raising the flashboards installed on the sill for this purpose. A hoisting cable and motor are provided so that the supporting struts of these boards can be drawn quickly. A wooden log-boom extends several hundred feet upstream from the dam, protecting the headrace from floating material. A combined rack and gate structure crosses the race just below the boom, and is supported by steel-and-concrete abutments, di-

viding it into seven 20-ft. openings, so arranged that planking can be inserted between the rack timbers for shutting off the flow when necessary. The forebay measures 200 ft. x 300 ft.

The generating station is a brick structure 33 ft. x 272 ft., on a massive concrete foundation forming part of the dam, and houses nine 295-hp and one 135-hp water turbines and a 1500-kw alternator and exciter. The nine main water-wheels are of the 68-in. Leffel vertical-shaft type, connected through Dodge bevel gears to a horizontal shaft 200 ft. in length, which drives the 1500-kw General Electric 2300-volt, 60-cycle, three-phase alternator at 180 r.p.m. The long horizontal shafting is made up in three sections connected by clutches so that only the required capacity of water-wheels need be operated to conform to the demand on the station. The shaft ranges in diameter from 10 in. at the generator to 7 in. at the far end. The speed of the main water-wheels is controlled by two Lombard governors. The 50-kw exciter is driven by a 135-hp, 40-in. Leffel water-wheel, with a Lombard governor. A spare exciter is also arranged to be belted from the main shaft in case of accident to the turbine-driven unit.

For serving the town of Buchanan, a mile distant, the 2300-volt, 60-cycle, three-phase generator buses are extended directly to the local distribution primaries. A 50-light regulating transformer also provides a constant current for the 33 6.6-amp series arc lamps which illuminate the streets. The major part of the output of the Buchanan water-power is, however, combined with that produced by the other hydroelectric plants of the system at Berrien Springs, Twin Brook and Elkhart, which are tied together by transmission lines with a 5500-kw steam auxiliary at South Bend. The 25,000-volt line from Berrien Springs to Niles is brought through the Buchanan water-power station, paralleling the local machine with the system. Three 500-kw water-cooled transformers are installed to raise the generator bus voltage to the transmission potential. The incoming and outgoing circuits are protected by fused stick-type circuit-breakers.

The daily output of the Buchanan station ranges from 18,000 kw-hours to 30,000 kw-hours. Part of this energy may be considered as going to supply the electric railways and lighting circuits of a number of cities which derive their electricity from the Indiana & Michigan Electric Company, including

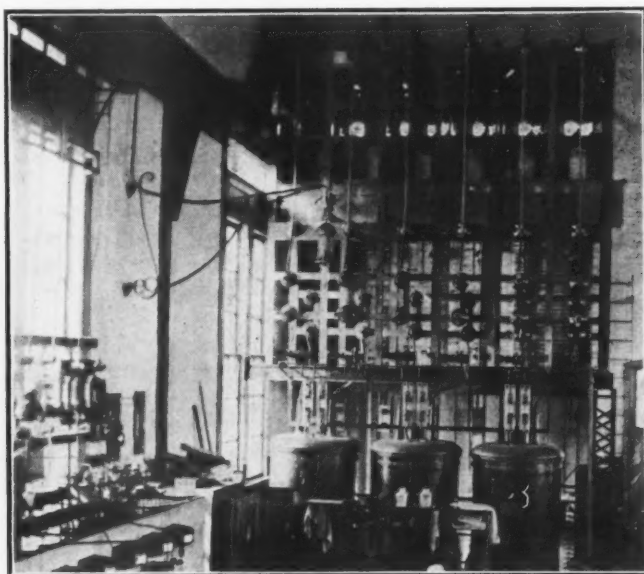


Fig. 3—High Tension Switchboard, Buchanan Station.

Benton Harbor, St. Joe, Berrien Springs, Buchanan and Niles in Michigan, and South Bend, Twin Brook and Elkhart in Indiana.

In Buchanan the company has 250 lighting customers, practically all of whom have meters installed. Eighteen other customers have a total connected load of 500 hp in motors, the installations ranging from 150 hp down. The local manufacturing plants which are operated by electric motors include a

large tool works, a belting factory, an axle works, a zinc horse-collar factory, and a feather-duster factory.

To motor users, energy is supplied on a flat rate of \$25 a hp-year, permitting the use of the full load continuously 10 hours a day, without limitations as to the time of the peak lighting load. A metered rate is also offered, ranging from 6 cents to 0.84 cent a kw-hour, depending on the quantity con-



Fig. 4—Special Tungsten Street Lighting, Buchanan.

sumed. The average rate at which energy is sold under this charge is 1.6 cents a kw-hour.

Commercial lighting circuits are supplied at rates of 7 cents and 5 cents a kw-hour where the income from the installation exceeds \$40 a year. Below this quantity a rate of 12 cents a kw-hour, subject to a 33 $\frac{1}{3}$  per cent discount for payment within 10 days, is offered, making this charge virtually 8 cents a kw-hour. Residence lamp circuits are furnished with energy at a nominal straight rate of 15 cents a kw-hour, which the 33 $\frac{1}{3}$  per cent discount reduces to 10 cents a kw-hour.

The company supplies 37 arc lamps for street lighting at a yearly contract rate of \$53 a lamp. Recently the main street of Buchanan has taken on urban airs by the installation of special tungsten lighting carried on pillars. There are 22 of these posts, with five-lamp fixtures at corners and three lamps on the intermediate posts, aggregating 94 40-watt multiple tungstens. These lamps and posts were installed by the town at an expense of about \$1,000, and are supplied with electricity by the company at a charge of \$34.34 per month.

The Buchanan water-power was formerly owned by the C. A. Chapin Light & Power Company, but has been since acquired by the Indiana & Michigan Electric Company, of which Mr. Chapin is president and Mr. F. A. Bryan general manager. Mr. H. W. Riley is local manager at Buchanan and Mr. C. E. Babcock operating engineer at the plant.

### ELECTRICITY IN IRRIGATION.

#### The Irrigation Pumping Plant of the Mosida Fruit Lands Company in Utah.

**D**URING the past winter and spring the Mosida Fruit Lands Company installed along the shores of Utah Lake an electric irrigation pumping plant—the nucleus of a system that will be, when completed, probably the largest in the country using electric energy exclusively. The system, when completed, will irrigate a tract of nearly 10,000 acres of land that has hitherto been entirely unproductive, even though it lay along the shore of the largest body of fresh water in the West.

The natural conditions could scarcely have been better for a development of this kind. Here was land of such a quality that, when irrigated, would be very valuable, and, adjoining it,

a fresh-water lake. The slope was gently toward the lake, and neither height of lift nor length of pipe lines was great enough to make the requirement of power excessive, and withal the 44,000-volt transmission lines of two water-power companies ran within a few miles, and electric energy was obtainable at very low rates during the irrigation season. Investigations and surveys were completed and contracts let for the first unit of machinery late in 1909, and early in 1910 sufficient water was delivered for about 2000 acres of land.

The installation is interesting from an electrical viewpoint in that energy will be used during the summer months only, at which time the transmission company has a comparatively light load. When the system is complete, about 1200 hp will be used at practically 100 per cent load-factor during the irrigation season and between 2,000,000 and 3,000,000 kw-hours of energy will be consumed each year. Although the price charged per kw-hour is extremely low, the gross income to the transmission company will be considerable.

The tract will be irrigated from three ditches lying at heights of about 60 ft., 110 ft. and 200 ft. above the datum plane of the lake. The main pumping plant now constructed is at the shore of the lake, while the upper plant will be located about two miles distant. There is only one pumping unit in service at this time, but the building and intake were constructed of ample size for the final installation. This first unit, rated at 150 hp, elevates water into the lower ditch sufficient in quantity for about 2600 acres of land. There will be two additional units, each of 375 hp, to elevate water to the middle ditch, and one of 275 hp in the upper plant, to elevate water from the middle to the third and highest ditch. All of the details of the complete system were worked out before any equipment was purchased, and each portion now installed will be in harmony with the remainder, when all is in operation.

Energy was obtainable at 44,000 volts, three-phase and 60 cycles, and it was decided to install a substation alongside of the main plant to deliver 2200 volts for all of the motors.

For a final continuous motor load of nearly 1200 hp a transformer equipment of 1200 kw was determined upon, and in order that the first units installed might comprise an integral part of the whole, three transformers of 200 kw each were

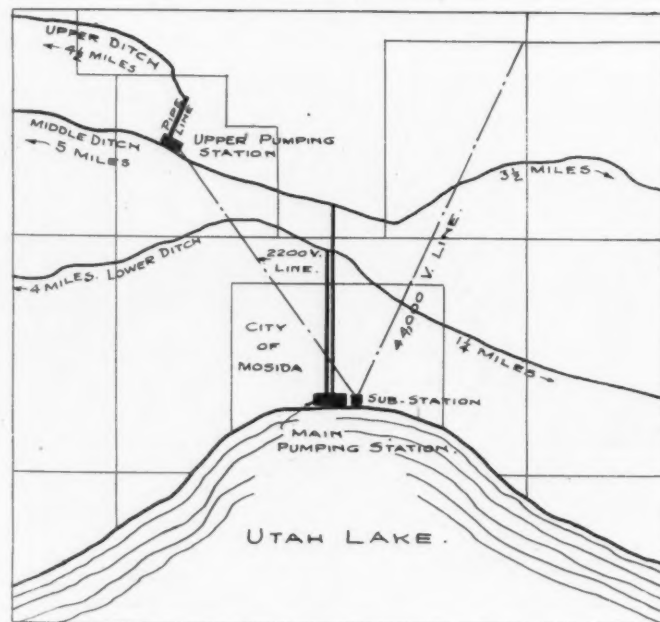


Fig. 1—Map of Ditches, Pipe Lines, and Transmission Lines.

purchased, and connected in closed delta, in a substation built of concrete located only a few feet from the pump house. These have a rating four times that required for the present motor, but as six of this size will complete the substation, this selection was made. The primary connections are arranged for 44,000 volts, 41,800 volts and 39,600 volts, and the secondary for 2200 volts. They are of the oil-insulated, water-cooled type, and the water for cooling is taken from the discharge pipe of

the pump. The transformers are protected by a set of General Electric aluminum-cell lightning arresters, with horn-gap disconnecting switches and primary fuses. A three-conductor cable laid in conduit is used to carry the energy to the motor by way of the panel upon which an oil-break switch is mounted, along with the auto-transformer, fuses, watt-hour meter and an ammeter. A branch leads to a 3-kw, 2200-volt to 110-volt transformer, from which energy is taken for the 2-hp, single-

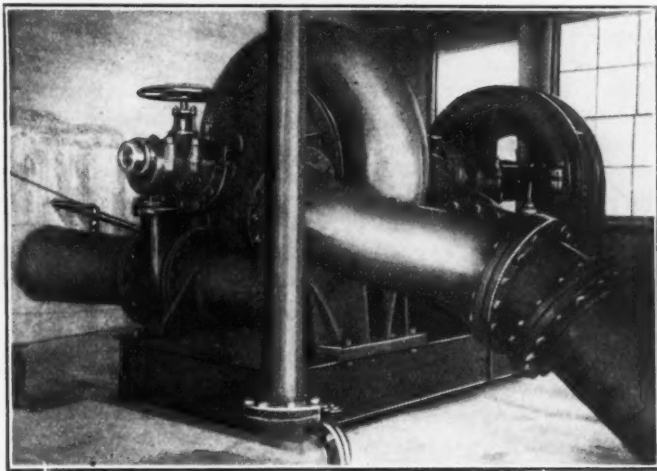


Fig. 2—Three-Phase Motor Connected to Centrifugal Pump.

phase motor used to operate the vacuum priming pump and for the lamps on the premises.

The first unit now in operation consists of a 150-hp, three-phase, 2200-volt, 600-r.p.m. induction motor, directly coupled to a 15-in. horizontal centrifugal pump with a rating of 15 cu. ft. of water per second pumped to a height of 60 ft. plus friction in the pipes. The pump is set upon a concrete foundation 6 in. above the maximum high water of the lake and is constructed with a double suction and "Y" connection terminating in a 15-in. flange. The suction pipe is about 20 ft. in length and increases in diameter from 15 in. at the pump to 30 in. at the inlet. It is made of No. 10 gage galvanized iron, double-ripped and soldered to make it perfectly air-tight. The sump from which the water is taken is built of concrete, with wing walls and a trash rack 8 ft. x 13.5 ft. made of bars of steel spaced about 1.5 in. apart to prevent the access of drift wood, etc., to the pumps. This rack is arranged on a slope in order that it may be readily cleaned of weeds, etc. The building is made of concrete, with a floor space of about 21 ft. x 38 ft. The present pump is located near one end, and openings have been left in the walls for the suction and discharge pipes of the two future units. The discharge pipe of the present unit is 3600 ft. in length and with an average diameter of 30 in. there is friction equal to about 5 ft., making the total pumping head about 65 ft. At the pump this pipe is 15 in. in diameter, but the diameter increases at once to 29 in. in a taper 10 ft. in length. One-half of it is 29 in. and one-half 31 in. diameter. The hill rises rapidly at an angle of 30 deg. just back of the plant and the pipe is turned up through this angle with an easy curve made on a radius of 12 ft. After rising 30 ft. it makes another similar curve nearly to the horizontal, after which the rise is gradual, there being only 30 ft. in over 3000 ft. The first 80 ft. of the pipe is made of No. 8 gage steel and the rest of No. 12 gage. The whole of it is double-ripped in the longitudinal seams and single in the transverse. Each 20-ft. length was dipped at the factory in a hydrocarbon compound impervious to moisture, and after arrival in the field, these sections were riveted together in the trench and covered with earth. No expansion joints are used.

The pump is equipped on the discharge side with a gate valve, which serves the double purpose of holding the vacuum when the pump is being primed and regulating the quantity of water discharged at all times. Only about two-thirds of the

full rated output of the pump has thus far been required. When the flow of water is thus restricted, the load on the motor decreases almost in proportion and 100 hp at the motor delivers about 10 cu. ft. of water per second. The vacuum for priming is created by means of a dry vacuum pump driven by a small single-phase motor, the pipes being so arranged that water cannot reach the vacuum pump. The vacuum pipe is tapped into the top of the shell of the centrifugal pump and priming is accomplished by closing the controlling gate valve and operating the vacuum pump until water is drawn from the shell. The valve in the vacuum pipe is then closed and the pump motor started; after full speed is attained, the controlling valve is opened part way until the discharge pipe is filled, and then full way if the corresponding amount of water is required.

The pump and motor are mounted upon a steel and cast-iron base, with a flexible leather-link coupling between the shafts. Each is equipped with two ring-oiling bearings, so that the personal attention required is practically negligible. Thus far the plant has been operated for about 12 hours each day and at only two-thirds output, but it is adapted for continuous service, and after the full 2600 acres under this ditch are under cultivation, it will often be run for weeks at a time without stopping.

When the rest of the equipment has been installed and the plant is complete, it will supply water to 9500 acres of fruit land. The present ditch covers 2600 acres, the middle one 4000 and the upper one 2900. About 40 cu. ft. of water per second will be pumped into the middle ditch lying at a height of 110 ft., by means of two pumps similar to the one now in operation. Each will be connected to a 375-hp motor and the two will deliver water into a pipe line about 5000 ft. in length. Water for the upper ditch will be taken from the middle one by means of a similar pump driven by a 275-hp motor, delivering water to an additional height of 90 ft. through about 1200 ft. of pipe. Three transformers similar to those now installed will be added and the plant will be complete. About 1000 acres of land have already been planted with fruit trees and grain, the ground being broken by means of a traction engine and gang ploughs.

The land is being divided into 5-acre and 10-acre tracts and sold to settlers, usually under an agreement whereby the irri-

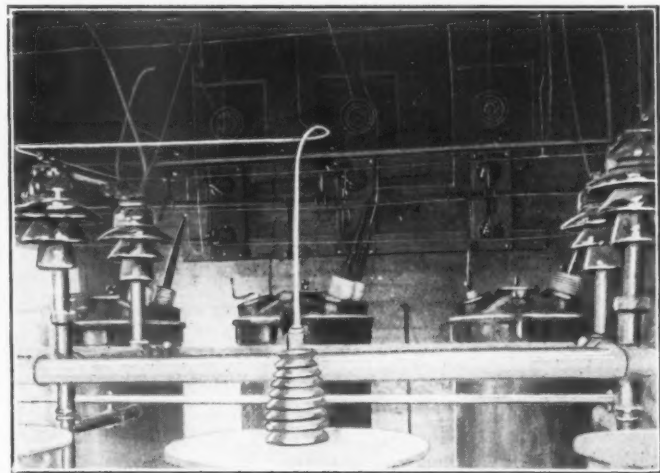


Fig. 3—Transformers, Lightning Arresters, Switches, Etc.

gation company plants the orchards and takes care of them for from three to five years, or until they are in bearing.

The irrigation company installed the substation and the 44,000-volt line connecting with the main transmission line, and thereby secured an excellent contract for energy, based only upon a kw-hour charge without any cost for readiness-to-serve. There is, however, a minimum charge for each month, equal to a certain proportion of the total charge for the previous month. This land will require somewhere between 12 in. and

18 in. of water each season, and to supply this depth over 9500 acres when the plant is completed, and the full acreage under cultivation, the pumps will run for between 2080 and 3120 hours or from 3 to 4.5 months of continuous operation. The cost of energy will lie somewhere between \$2.20 and \$3.30 per acre of land. The cost of labor will be little beyond that required for maintaining the distributing ditches, and the repairs and depreciation upon the equipment should be covered by a very small charge.

It is evident that the total cost of delivering water upon this land irrigated by means of electric motors will be less than the interest charges alone under many irrigation projects, the water for which is secured from expensive dams, reservoirs and long ditches. The cost of such systems is frequently over \$60 per acre, making the annual interest upon the investment \$4.80 at 8 per cent, the rate that farmers usually pay in the West. Under a well-designed motor-service irrigation project, the cost of the complete system seldom exceeds \$15 per acre of land irrigated, and a farmer can far better afford to pay for energy and interest a sum equal to the interest alone upon the larger investment of a gravity system, since he owes only \$15 per acre upon his land, instead of \$60. This is only one of the factors that make motor irrigation projects so popular, and as long as desirable land, ample water and cheap energy can be brought together, thus long will they be developed. Land that has been dry for centuries is usually wonderfully productive when irrigated, and when planted for fruit a family cannot well take care of as much as 10 acres. The rapidity with which such irrigated fruit tracts are being settled is wonderful and as the desirable land that can be irrigated by gravity is becoming scarce, one can look to electricity for the greatest and best future results.

### A NEW FORM OF DIRECT-READING CANDLE-POWER SCALE AND RECORDING DEVICE FOR PRECISION PHOTOMETERS.

BY GEORGE W. MIDDLEKAUFF.

THE new form of candle-power scale herein described was designed for use in the precision photometric work of the Bureau of Standards, and is the result of an attempt to combine the direct-reading feature of the ordinary commercial photometer candle-power scale with the accuracy possible in the use of the precision photometer. It is intended to be used in connection with an automatic recording device, also designed for use in the Bureau of Standards, and described in the *Transactions* of the A. I. E. E.<sup>1</sup> The automatic recorder eliminates the labor and possible errors of reading and recording the great number of settings made in a series of photometric measurements; while the direct-reading scale, described below, eliminates the labor and possibilities of error involved in the considerable computations heretofore necessary in finding the values of the lamps in terms of the mean of a group of standards.

#### THE PRECISION PHOTOMETER AND METHOD OF MEASUREMENT.

The precision work of the Bureau in the photometry of electric incandescent lamps is done on a standard photometer of the Reichsanstalt pattern, supplied with a Lummer-Brodhun contrast screen, and the measurements are made by the substitution method. That is, the standards and the lamps to be compared with them are placed, in turn, in the socket near the left end of the bar, or "test side," and are balanced against a comparison lamp placed near the right end, or "comparison side." In order to eliminate all variables on the comparison side and thus carry out the substitution method of measurement more perfectly, the carriage, on which the comparison lamp is mounted, is connected rigidly, by means of adjustable rods, to the carriage supporting the photometer screen. As the comparison lamp thus moves with the screen remaining at a constant distance from it, the candle-powers of the lamps

measured are directly proportional to the squares of their respective distances from the screen when set at photometric balance.

#### OLD METHOD OF READING AND RECORDING SETTINGS.

Before the introduction of this new device the photometric settings were read, by the observer, from a centimeter scale graduated on the bar and the readings were recorded by hand in a book provided for the purpose. From 5 to 15 settings and corresponding readings of the scale, according to their range, were made on each lamp, thus making it necessary for the observer to record from two to even as many as five times during the measurement of each lamp, it being impossible to retain in mind more than about three readings at a time and record them correctly.

This method of reading and recording is objectionable because it consumes considerable time and involves the liability of error, both in reading and recording, besides unnecessarily fatiguing the eye by alternate reading of photometer screen and scale.

#### OLD METHOD OF COMPUTING CANDLE-POWER.

The readings having been recorded and the mean reading found for each lamp, it was then necessary, in order to find the candle-power values, to perform a tedious set of computations, as shown by the following formula:

$$X = \frac{A + B + C + D + E + F}{a^2 + b^2 + c^2 + d^2 + e^2 + f^2} \cdot x^2$$

where  $A, B, C, D, E$  and  $F$  are the values of the six standards (it being desirable to use at least this number in every set of measurements) and  $X$  is the value of any lamp compared with them; while  $a, b, c, d, e, f$ , and  $x$ , are the corresponding, respective, mean distances of the lamps as read from the centimeter scale on the bar. Although these computations were much abbreviated by the use of a set of tables prepared especially for this purpose, nevertheless the work was very tedious, involving, at the same time, the liability of error, thus making it absolutely necessary to have all the numerical work checked by a second computer whose task was equally laborious and required fully as much time as that of the first.

The ordinary direct-reading candle-power scale, such as used on commercial photometers, cannot be well adapted to this class of work, because for precise measurement it is practically impossible to adjust the comparison lamp properly to fit the scale with the necessary accuracy; especially since, as stated above, it is desirable to employ at least six standards in the adjustment.

#### THE NEW FORM OF SCALE.

It occurred to the author that if a candle-power scale were so constructed that it would automatically adapt itself to all the requirements of the comparison lamp adjustment, thus reversing the usual process of adjustment, the difficulty, mentioned above in regard to the use of a commercial photometer scale in precision work, could be completely overcome, and as a consequence the computations for candle-power would be entirely eliminated. It was found that such a scale could be computed and constructed in a very simple and satisfactory manner as explained below and as will be understood by referring to the accompanying figure.

The scale proper is the rectangular area  $ABDC$  and is calculated on the basis that a 16-cp lamp is to be photometered at a distance of approximately 120 cm from the lamp, a range of 6 cm either side of 120 cm being made possible in the construction of the scale. The sides  $AB$  and  $CD$  of the rectangle are two ordinary linear candle-power scales calculated to suit the arrangement of the photometer as described in the second paragraph above, and the points of graduation were determined by means of the formula,

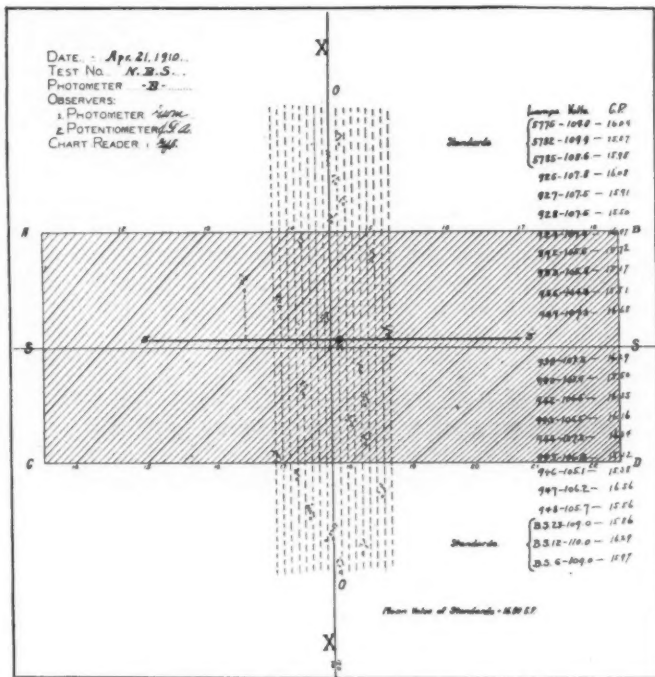
$$\frac{X}{16} = \frac{x^2}{a^2}; \text{ or, } x = \frac{a}{4} \sqrt{X}$$

where  $a$  is the distance of the 16-cp point of graduation from the lamp (or zero of the scale), being 126 cm for the scale  $AB$ , and 114 cm for the scale  $CD$ ; and  $x$  is the corresponding distance of any other candle-power point  $X$  on the scale which is

<sup>1</sup>In a paper on "Carbon Filament Lamps as Photometric Standards," presented by E. B. Rosa and G. W. Middlekauff at the annual convention, June 28-July 1, 1910.

being calculated. The rectangle was made 30 cm in length so as to include the candle-power points most commonly required in standardizing work, these being indicated along the sides *AB* and *CD*. The balance for lamps having values above or below those indicated (for instance, 32-cp or 8-cp lamps) may be thrown within this range by means of rotating sectored disks placed on the proper side of the photometer screen. The diagonal lines join the corresponding 1/10-cp points of graduation in the two scales; and since the scales are divided proportionately, all the diagonal lines must converge toward a common point in a line drawn through zero and perpendicular to the two scales. The obliqueness of the diagonal lines, as a system, depends upon the distance between *AB* and *CD*, which may be chosen arbitrarily; but to prevent too much crowding of the diagonal lines, on the one hand, and too large a rectangle, on the other, the 16-cp diagonal line was drawn so as to make an angle of 45 deg. with the sides *AB* and *CD*, the other diagonal lines being drawn in their proper directions accordingly. The rectangle thus becomes 12 cm in width and, as stated above, it was arbitrarily made 30 cm in length.

Now, any line drawn across the diagonal lines and parallel to the length of the rectangle will be divided in exactly the



Candle-Power Scale and Record Sheet.

same proportion as *AB* and *CD* and will, therefore, be a candle-power scale also. Hence, this rectangle includes an indefinite number of linear candle-power scales and corresponding to any fixed adjustment of the comparison lamp that will throw the 16-cp balance at any point within the 12-cm range (between 114 cm and 126 cm from the lamp), there will be, in the rectangle, a linear scale which will exactly fit all the requirements of the comparison lamp adjustment. The method of determining the exact position of the proper linear scale for any given adjustment will be fully explained below.

Two important reference lines, *XX* and *SS*, are drawn across the figure perpendicular to each other and to the sides of the rectangle, intersecting the 16-cp diagonal line at its middle point, which is also the middle point of the rectangle and is at exactly 120 cm from the lamp, or zero. The line *XX* will, hereafter, be called the "Index Line," being the line by which the diagonal scale is set at its proper distance from the lamp mounted at zero on the photometer bar; and the line *SS* will be called the "Standard Scale," as it is the linear scale on which 16 cp falls at exactly 120 cm from the lamp, this being the distance adopted in the Bureau's practice as standard in the comparison of electric incandescent lamps of 16-cp intensity, the illumination of the photometer screen under these conditions being very approximately one ft-candle.

THE PAPER RECORD SHEET.

The rectangular figure, as described above, was very accurately drawn just double the required dimensions, and after being photographed down to exactly the correct size, it was transferred to a copper plate etching from which it was printed, in olive green, on sheets of white paper about 35 cm square, one of these sheets being intended for each separate set of lamps photometered.

The paper used for this purpose was specially prepared to withstand changes in dimension due to the ordinary variations in atmospheric moisture. As a further precaution, the longer dimension, which is the important one to keep constant, was printed parallel to the machine direction of the paper—that is, to the direction in which it is the least affected by changes in moisture.

THE RECORDING DEVICE.

While observations are being made, one of the printed sheets of paper may be held under the photometer carriage by means of a flat table, movable at right angles to the photometer axis, or, as is actually done at the Bureau, it may be wrapped on a cylinder whose axis is parallel to the photometer bar. By pressing a key located on the photometer carriage the observer prints on the paper a record dot for each setting as it is made, this being done by means of a printing electromagnet suspended from the photometer carriage by a metal rod, the magnet being provided with two revolving spools carrying a carbon ribbon between the printing point and the sheet on the cylinder. The cylinder rests on the frame of the photometer bench and is turned on its axis by means of a friction clutch which permits it to be turned by hand, if desired, without disturbing the clock. The clock and the printing magnet are operated in series by a battery of six cells, the magnet printing when the key is closed, the clock turning the cylinder 1/2 mm when the key opens. The record dots are thus prevented from falling together, and by their relative positions, they show the order in which the settings are made.

THE NECESSARY ADJUSTMENTS.

The complete adjustment of the apparatus preliminary to making a series of measurements is simply as follows: The photometer carriage is set at 120 cm on the bar and the paper record sheet is wrapped on the cylinder with the index line immediately under the printing point and overlapping at its opposite ends. Then with a standard 16-cp lamp, burning at its correct voltage, in the socket at zero on the test side, and the comparison lamp burning at the proper voltage to match the standard in color, the rods connecting the photometer and comparison lamp carriages are adjusted so as to throw the intensity balance anywhere within 6 cm either side of the index line, and the apparatus is ready for the measurements to be made. The only adjustment requiring any degree of care is that of placing the index line at its proper distance from the lamp.

RECORDING THE SETTINGS.

Settings are now made on the standard lamp and a corresponding group of record dots is made near the top of the sheet. The standard is then removed, the cylinder is turned by hand a distance sufficient to separate the group of dots already made from those to follow, and other standards, if desired, or lamps to be photometered are placed, in turn, in the socket and for each lamp the settings are recorded by a corresponding group of dots, as before. The record is thus continued down the length of the paper until all the lamps of the set are photometered.

A photographic reproduction of a completed record sheet, or chart, of a series of measurements actually made in this manner on a set of six standards and 17 lamps compared with them is shown in the accompanying figure, the lamps under measurement being part of a lot designated as "N. B. S." lamps. In the three columns of figures along the right margin are given the numbers of the lamps in the order they were photometered and recorded by the dots, together with their respective voltages and corresponding candle-power values. The cross-mark under each group of dots indicates the average position of the indi-

vidual dots of the group. The candle-power values were read from the linear scale  $S'S'$ , whose correct position was determined in the manner described below. This will be referred to hereafter as the "Record Scale," being that scale which fits the record printed on the sheet.

#### READING THE RECORD.

With the chart on a drawing board and a T-square placed with its edge parallel to the index line, preliminary relative candle-power values of the six standards were read from the standard scale and each reading was recorded by a mark on the scale as shown. These readings, in the order of the record of the standards, were 16.15 cp, 15.98 cp, 16.09 cp, 15.97 cp, 16.40 cp and 16.08 cp, respectively, their mean being 16.11 cp. As the true mean value of these six standards was 16.00 cp, it is evident that the linear record scale  $S'S'$  must lie above the standard scale and at such a distance from it that the 16.00-cp point on  $S'S'$  falls on the line  $OO$  which was drawn (by means of the T-square) perpendicular to the standard scale at its 16.11-cp point.

The simplest method of determining the proper position for the record scale is to consider the line  $OO$  as a linear candle-power scale and draw the record scale intersecting it at the point where the reading is the mean true value of the standards—that is, at 16.00 cp for this particular case. No appreciable error is introduced by considering the line  $OO$  as a candle-power scale, because at this part of the rectangle the diagonal lines are so nearly parallel to each other that, for practical purposes, we may consider  $OO$  divided in the same proportion as the standard scale and the reading at the intersection of  $OO$  and  $S'S'$  will be the same on both.

With the record scale  $S'S'$  properly drawn, it becomes a simple matter (by means of the T-square) to read off the correct values in candle-power directly and as rapidly as it is possible to set the edge of the T-square over the centers of the various groups of record dots. It has been found by experience, however, that, instead of simply reading off the values in this manner, it is better practice to draw a line through the intersection of each diagonal line with the record scale, a sufficient number of such lines being drawn to include all the groups of record dots close together in value. In the case of groups which are scattered, as for instance the group corresponding to the eighth lamp in the set, it is better to draw lines directly from the centers of the groups to the scale. The advantage of having these lines on the chart is that the values can be more easily and accurately read; and especially that the record is thus made more complete and permanent, permitting it to be checked in a few moments by a second reader.

The values of all lamps of the set, including the standards, are read off to the nearest 0.01 of a candle and written along the margin. If the linear record scale has been carefully drawn at the proper distance from the standard scale, the mean of the standards, as read from it will equal, to within 0.01 of a candle, the true value of their mean. The true candle-power values of the individual standards used in the set given in the figure were, in the order recorded, 16.00, 15.90, 15.98, 15.82, 16.33 and 15.96 respectively. A comparison of these values with those read from the scale and recorded on the chart gives a fair indication of the accuracy of the measurements made on the photometer.

#### VALUES READ WITHOUT A RECORD.

Although, for the sake of obtaining a permanent record, the settings are usually recorded by dots on the sheet of paper, yet it is not at all necessary to do so. By means of a cross-hair reading index suspended from the photometer carriage the relative values of the standards may be read from the standard scale which is brought immediately under the cross-hair by turning the cylinder. The cross-hair is then set at the mean reading of all the standards and the cylinder is turned until the reading on the diagonal scale, corresponding exactly to the true value of the mean of the standards, falls immediately under the cross-hair. The cylinder is then clamped (no clock being required), and all is ready for the set of measurements on the lamps to be compared with the standards.

With the scale used in this manner it becomes a valuable adjunct to a commercial photometer. It has all the advantages of the ordinary commercial scale and has the further advantage of quick and accurate adjustment without a tedious adjustment of the comparison lamp which is arbitrarily set at the beginning and need not be changed thereafter either in voltage or distance. In using this scale it is, of course, necessary to have the comparison lamp movable with the photometer screen and kept at a constant distance from it throughout the set of measurements.

#### A MORE EXTENDED APPLICATION.

The scale slightly modified may be extended in its use to the testing of lamps which are placed successively at different points along the bar on the test side. It may be used also in reading a record made on a separate sheet of perfectly plain paper. These cases will be fully discussed by the author in a more extended article which will appear in the near future in the Bureau of Standards Bulletin.

#### CONCLUSION.

This combination candle-power scale and recording device has been in use in the Bureau of Standards almost daily for the past eight months and has proven itself entirely satisfactory. It has eliminated the computations which formerly occupied the entire time of at least one computer, and sometimes that of two. The results of a half-day's work on the photometer can be read off and written on the record sheet in but a few minutes, and the final record can be checked entirely by inspection. There are no tedious preliminary adjustments required and the photometer settings are made and recorded rapidly and accurately. The eye is not unnecessarily fatigued by alternate reading of the photometer screen and scale, and the observer is almost entirely freed from prejudice in reading. The record is simple, permanent and complete, and is easily read, checked and filed.

Bureau of Standards, Washington.

## THE PHYSIOLOGICAL TOLERANCE OF ALTERNATING-CURRENT STRENGTHS UP TO FREQUENCIES OF 100,000 CYCLES PER SECOND.

BY A. E. KENNELLY AND E. F. W. ALEXANDERSON.

IT was announced many years ago by Tesla,<sup>1</sup> Elihu Thomson<sup>2</sup> and D'Arsonval,<sup>3</sup> that alternating currents of high frequency produced little sensation when passed through the human body, compared with alternating currents of low frequency and equal strength. This relative insensibility to high-frequency currents was attributed by D'Arsonval to the inability of the sensory nerves to respond to high-frequency stimuli. It is known that an alternating current of sufficient strength to light up an ordinary  $\frac{1}{2}$ -amp incandescent lamp, included in circuit with the body of an observer, can be easily tolerated at very high frequencies, although only a small fraction of that current strength could be supported without distress at ordinary industrial frequencies up to 150 cycles per second.

Beyond the above facts, but little appears to be known, from the physical standpoint, concerning the influence of frequency on the physiological sensibility of the human body to the passage of alternating currents.

In making observations of alternating-current toleration, it has been difficult to determine the frequency or frequencies employed, owing to the nature of the generating apparatus. This apparatus has in nearly every case consisted of a condenser, discharging through an inductive circuit including the body of the observer. Very recently, however, it has been found practicable to construct, for industrial purposes, alternators giving frequencies up to 100,000 cycles per second. The frequency of these machines is readily measured and controlled. The ma-

<sup>1</sup>N. Tesla, "Experiments with alternate currents of very high frequency and their application to methods of artificial illumination." *Trans. Am. Inst. El. Engrs.*, May 20, 1891, Vol. 8, pp. 267-319.

<sup>2</sup>Elihu Thomson, "Physiological Effects of Alternating Currents of High Frequency." *Elec. World*, N. Y., Vol. 17, No. 11, March 14, 1891, p. 214.

<sup>3</sup>D'Arsonval, *L'Ind. Electrique*, March 25, 1893.

achines can deliver a steady terminal potential-difference and current, both of which can be easily measured with hot-wire instruments.

The writers have made a series of measurements on different individuals to determine their relative sensibility to alternating-current strengths at different frequencies up to 100,000 cycles per second, using one of the above-mentioned high-frequency alternators for this purpose.

*Application of the Current.*

In all of the measurements, the current was passed through the arms and across the chest, by inserting the hands of the subject, up to the wrist (ulnar condyle), in jars of saline solution containing electrodes connected with the alternator. The alternating current, entering the body through the skin of the hands, distributes itself through the liquid electrolytes within the arms, and must diffuse through the chest and trunk of the body. It is well known that when a high-frequency current passes through a cylinder, wire, or prism of good conducting material, such as copper, and particularly a good electrical conducting material with strong magnetic properties, like iron, it penetrates only to a small depth within the conductor, or is confined to a thin surface layer; this effect is commonly called the "skin effect." The skin effect is, however, easily demonstrated arithmetically to be very small with conductors of such relatively low conductivity as saline solutions, so that unless our quantitative data and formulas for the skin effect are very largely wrong, it is certain that the skin effect in the human body is practically negligible, and that up to the highest frequency here considered,

of a series or shunt condenser. The voltage and current that can be selected for full output may be varied widely, depending upon the capacity and connection of the condenser, under the limitation that the current should not exceed 40 amp in multiple connection. In the experiments here described, a resistance and condenser load (*R, C*, Fig. 1) was used to raise the voltage

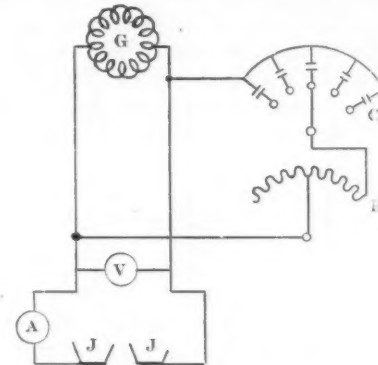


Fig. 1—Electrical Connections Employed in Tolerance Tests.

above the normal no-load voltage. The maximum voltage used in the tolerance test was 360 volts, with a corresponding current of 0.8 amp taken through the body. The machine was driven by a direct-current electric motor at the full speed of 20,000 r.p.m., through gearing of velocity increasing ratio 10:1. By reducing the speed of the driving motor, the frequency of the

TABLE OF OBSERVATIONS.

I Initials of Subject	II Frequency Cycles per Sec <i>n</i>	III P.D. Volts	IV Tolerance Current Ampere <i>I</i>	V Inferred Resistance Ohms	VI Tolerance Cyclic Quantity $\frac{I/n}{1,000,000}$ Coulombs per Cycle	VII REMARKS
D. M.	100,000	250	0.5	500	5	Sensation of heat only.
	75,000	160	0.32	500	4.3	Slight muscular contractions.
	50,000	110	0.18	612	3.6	
	30,000	50	0.09	557	3.0	
	16,000	27	0.044	614	2.8	
	11,000	17	0.028	614	2.5	
A. E. K.	100,000	200	0.33	600	3.3	Tingling and warmth in wrists.
	50,000	100	0.17	590	3.4	Slight muscular contractions.
	30,000	35	0.07	500	2.3	
P. R.	100,000	360	0.8	450	8.0	Check test on a different date.
	50,000	125	0.2	625	4.0	Muscular contractions in arms.
	30,000	95	0.15	633	5.0	
	16,000	32	0.05	640	3.1	
	11,000	20	0.03	667	2.7	
P. M.	100,000	240	0.45	534	4.5	
	80,000	150	0.26	577	3.3	
	60,000	105	0.18	584	3.0	
	40,000	70	0.12	583	3.0	
	25,000	40	0.065	616	2.6	
	16,000	25	0.040	625	2.5	
	11,000	16	0.025	625	2.3	
C. M. S.	100,000	200	0.48	417	4.8	
	80,000	150	0.38	395	4.8	
	60,000	80	0.21	381	3.5	
	40,000	50	0.13	384	3.3	
	25,000	35	0.085	412	3.4	
	16,000	22	0.05	440	3.1	
	11,000	12	0.027	440	2.5	
J. T.	62.5	7	0.0055	1272	88	Muscular contractions in wrists and arms.
C. A. W.	62.5	7.1	0.0035	2020	56	" " " " " "
P. H. C.	62.5	8.4	0.0105	800	168	" " " " " "
A. E. K.	62.5	5.1	0.0041	1240	66	" " " " " "
C. P.	62.5	6.6	0.0053	1240	85	" " " " " "

the current diffuses throughout the cross-sections of the body in substantially the same manner as a continuous current.

*High-Frequency Alternator.*

The high-frequency alternator was a 2-kw machine with a stator double armature and an inductor rotor, as built by the General Electric Company for wireless telegraph and telephone work. The machine was similar to that described in a paper by one of the writers, last year,<sup>4</sup> before the American Institute of Electrical Engineers. It was designed to give either 110 volts or 220 volts on open circuit, with multiple or series connections respectively, and to deliver the full output of 2 kw with the aid

alternator was adjustably reduced. The wave form of the e.m.f. generated by the alternator is approximately sinusoidal.

*Electrical Connections.*

The electrical connections employed are indicated in the accompanying diagram Fig. 1. *G* is the high-frequency alternator, *C* is the variable condenser and *R* the variable resistance used in a shunt circuit in order to increase and regulate the voltage. *V* is a hot-wire voltmeter, *A* a hot-wire milliammeter, *JJ* metallic jars containing water with approximately 3 per cent of common salt. In the ordinary method of conducting the test, the generator voltage was reduced to a comparatively low value by lowering the excitation of the machine. The subject then inserted his hands in the jars *JJ*. The voltage was then slowly

<sup>4</sup>E. F. W. Alexanderson, "Alternator for One Hundred Thousand Cycles," *Proceedings Am. Inst. El. Engrs.*, June 6, 1909, pp. 655-668.

and steadily raised until the subject considered that any further increase would give him distress. The readings of current and voltage at the instruments *A* and *V* were then noted and the voltage again reduced. The speed of the driving motor would then be altered so as to obtain another frequency, and the measurement repeated. A series of such measurements would thus be obtained on the same subject at, say, five frequencies between 15,000 and 100,000 cycles per second, within an interval of about 20 minutes. The limiting current strength which the subject could take through his arms and body, without marked discomfort or distress, at any given frequency, may be designated as the *tolerance current* for that subject and frequency.

#### Observations.

The observations are collected in the above table. Column I gives the initials of each subject's name. Column II the frequency in cycles per second. Column III specifies the potential-difference at jar electrodes as measured by voltmeter *V*. The tolerance current is recorded in column IV, and the inferred resistance of the subject from the potential-

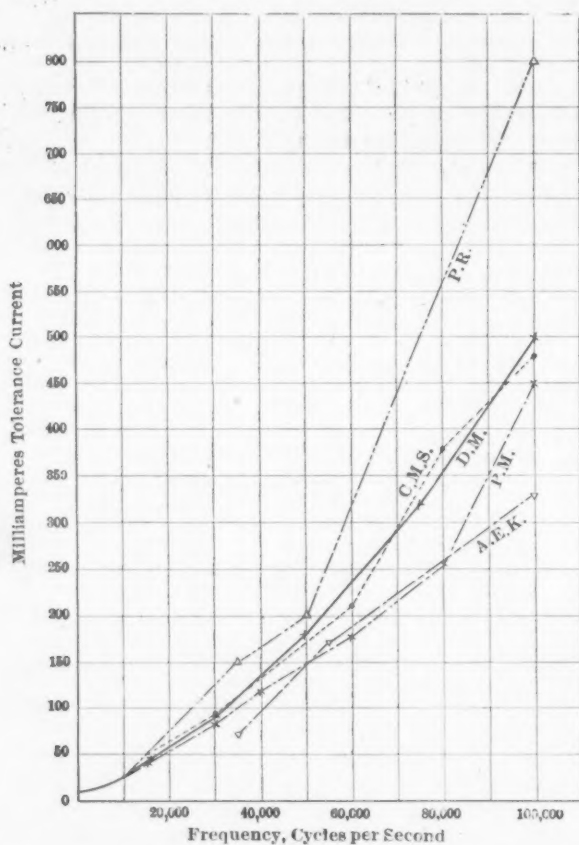


Fig. 2—Curves of Tolerance Current Strengths at Different Frequencies in the Cases of Five Different Subjects.

difference and current, including the resistance in jar solutions, is given in column V. Column VI gives the ratio of the tolerance current to the frequency. This ratio may be called the *tolerance cyclic quantity*. It is a quantity expressed in coulombs per cycle. The actual figures within the column give the result in virtual, or root-mean-square, microcoulombs per cycle. With a sinusoidal current wave, the maximum quantity of electricity passed through the body in each half-cycle will be this virtual quantity multiplied by  $\sqrt{2} \div \pi$ .

It will be seen that the tolerance current increases from 0.03 amp at 11,000 cycles per second to about 0.45 amp, or even 0.8 amp, at 100,000 cycles per second. This means that the tolerance cyclic quantity increases from about 2.5 microcoulombs per cycle at 11,000 cycles per second to about 4.5 microcoulombs at 100,000 cycles per second.

The last five observations were made near the ordinary light-frequency of 60 cycles per second. It will be seen that the tolerance e.m.f. varied between 5.1 volts and 8.4 volts with different subjects and the tolerance current between 4 milli-

amperes and 10 milliamperes. The tolerance cyclic quantity varied between 56 microcoulombs and 168 microcoulombs per cycle.

It was the unanimous testimony of all the subjects experiencing the high-frequency current that at or near 100,000 cycles per second there was a sensation of tingling and heat in the wrists, when the tolerance current was approached, but no muscular contractions were produced, either in the hands or arms. When the frequency was reduced to about 50,000 cycles per second, muscular contractions commenced in the muscles of the forearm. As the frequency was reduced below 50,000 cycles per second, the muscular contraction became more evident.

The tolerance currents for the high-frequency range 11,000 to 100,000 cycles per second, and are given in the accompanying curve sheet, Fig. 2.

#### Conclusions.

It is evident from the tables and curves that there is a very marked increase in the tolerance current strength as the frequency is increased from 11,000 to 100,000 cycles per second. A man can tolerate only about 30 milliamperes at 11,000 cycles per second, but can tolerate nearly half an ampere at 100,000 cycles per second.

Between 60 and 11,000 cycles per second there is not a very great change in tolerance current, namely, from about 5 milliamperes to about 30 milliamperes.

To a first approximation, between 11,000 and 100,000 cycles per second, the tolerance current strength increases with the frequency, although it is not certain that the increase follows a straight line law. Some of the subjects seem to follow nearly a straight line law of tolerance with frequency. Others seem to show a parabolic law, or a tolerance increasing faster than the frequency. Thus the mean tolerance cyclic quantity was 2.5 microcoulombs per cycle at 11,000 cycles per second and 5.3 microcoulombs per cycle at 100,000 cycles per second, or, roughly, twice as much at the upper as at the lower limit. It is difficult to say what the precise law is, from the observations thus far made. The tolerance current cannot be measured with great precision. It is a physiological estimate subject to variation, not only in different individuals, but also in the same individual at different times.

Since the mean tolerance cyclic quantity was nearly 100 microcoulombs per cycle at 60 cycles per second and seemed to diminish below 2.5 microcoulombs per cycle at 11,000 cycles per second, a minimum is to be expected somewhere between these limits, i. e., at some frequency between 60 and 11,000 cycles per second, a maximum sensibility to current should be looked for, in the sense of a minimum tolerance cyclic quantity  $I/n$ .

The reason for the increase of tolerance current with frequencies above 11,000 cycles per second is to be looked for in the condition of reduced nervous sensibility at high frequencies, as suggested by D'Arsonval. That is, it cannot apparently be accounted for physically; so that the explanation may be expected to be physiological.

## MOTOR VENTILATION.

Motors which are used almost entirely for producing torque and run very little, such as lifting motors for lifting tables in rolling mills, slip regulating motors in motor-generator flywheel, mine hoist outfits, etc., are designed to dissipate their heat at standstill and therefore require an excess amount of material over a motor of the same rating which has the benefit of ventilation produced when running at full speed. A patent issued to Mr. H. Müller attempts to remove this disadvantage by making the rotor of two members, one coupled to the work and the other free to rotate and fitted with ventilating or fan blades. The free rotor revolves at full speed whenever voltage is applied to the motor, irrespective of the speed of the working rotor, and in this way permits an excellent ventilation of the machine under all conditions.



## GASOLINE-ELECTRIC TRUCK FOR HAULAGE IN ARID REGIONS.

By W. D. HORNADAY.

A motor transportation line of unusual interest is in operation between Marathon and a point on the Rio Grande, 80 miles south of Marathon. The lead and zinc mines of the Del Carmen Mining Company are situated 5 miles from the international boundary stream on the Mexico side, and for several years the work of blocking out the ore has been going on, but the transportation problem was such a difficult one that shipments could not be made. The nearest railroad point is Marathon, on the Southern Pacific, 80 miles from the river crossing.

It was finally decided by the company to build an aerial tramway across the river in order to handle the ore through a territory that is absolutely impassable for anything but burros. This tramway is  $6\frac{1}{2}$  miles long, and was constructed at a cost of \$110,000, gold. The problem of transporting the ore from the Texas terminal of the tramway into Marathon was still unsolved, but the company constructed a fairly good wagon road all the way at a cost of about \$50,000, and a manufacturer of gasoline traction engines undertook to furnish motive power of that type which would handle the ore economically and speedily. These traction engines proved failures.

At this time Mr. W. G. E. Rolaff, a mechanical and electrical engineer, was asked by the company to devise some method of transportation. The problems to be met with consisted chiefly of the long distance, the absence of fuel of any sort along the route, and the lack of water, there being no water on the road for 40 miles. After thoroughly investigating the matter Mr. Rolaff decided that neither a gasoline tractor nor an electric truck would be satisfactory, under the circumstances, but a combination of the two.

This gasoline-electric truck has a four-cylinder gasoline engine, direct-connected to a 15-kw interpole compound-wound generator with a controller at the driver's seat. The frame of the car is built of 5-in. steel channels in which the subframe carrying the power plant is suspended from three points. The engine has no parts, such as gears, springs, valves, rods, etc., exposed, but all of these are run inside the crankcase and operate in a bath of oil. Lubrication is had by a self-contained system involving no oil pipes of any sort, and the tell-tale on



Fig. 1—Gasoline-Electric Truck.

the driver's seat is a perfect indicator as to the proper working of the oiling system. This construction was rendered necessary by reason of the enormous amount of grit and sand which is always present on the desert and to which the machine is naturally exposed.

The dynamo, which is connected to the engine by a flexible coupling, will carry an overload of 100 per cent with ease for a sufficient length of time to overcome any ordinary hard pulls. The voltage of this generator is 125.

As driving motors the Couple Gear Freight Wheel Company's wheels are being used. They consist of a steel shell enclosing a motor operating from pinions on the armature shaft engaging

racks mounted inside of the shell. For this particular purpose this construction is ideal, because it is dustproof, waterproof, protected against all possible abuse from outside influences and the motors are capable of a very heavy overload for a short time.

These motors are connected in such manner that by a simple throw of the controller lever the operator can change from a series connection to a series-parallel connection, and at no time will he jar the machinery as he would if he had to throw gear levers and clutches in a straight gasoline truck of the ordinary type.

The truck proper is suspended in front on semi-elliptical springs designed to carry the power plant, and in the rear on

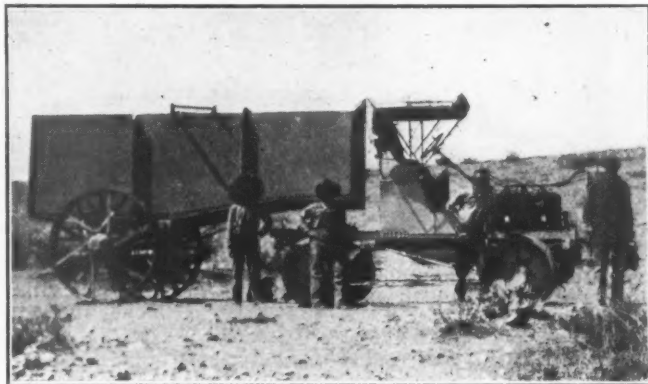


Fig. 2—Gasoline-Electric Truck.

semi-elliptical springs sufficiently heavy to carry a portion of the load of ore. The ore truck proper is, in fact, a two-wheel cart, 15 ft. long, the front part of which rests upon the rear part of the power truck. The connection between these two is made by a turntable and a universal ball-and-socket joint. This allows for all inequalities of the road and makes turning and backing a very simple operation. The wheels of the ore truck are 5 ft. in diameter, with a 10-in. face; the hubs are cast steel with 9-in. roller bearings and two ball-thrust bearings in each hub; the axle of the ore truck is  $4\frac{1}{2}$  in. square. The body of the truck will carry 15 tons of ore.

The truck carries 40 gal. of gasoline, which is sufficient to carry it over 80 miles or 100 miles of road. In addition to being a four-wheel drive, the truck also steers by all four wheels, which allows it to be operated around sharp and narrow mountain roads. Broadly speaking, the truck will travel one mile with a fuel consumption of approximately  $\frac{1}{2}$  gal. of low-grade gasoline. The truck makes a speed of 9 miles to 10 miles an hour without load on a good road, and will climb any grades that exist on the 80-mile run between Marathon and the Rio Grande. Some of these grades are as great as 14 per cent, but none of them is very long. When loaded the truck travels from 4 miles to 6 miles per hour, according to the road surface and the grade.

On the dashboard the operator has a combination voltmeter and ammeter, which instrument shows him at all times exactly what power the truck is consuming. During a recent series of tests it was found that when traveling at an average rate of from 8 miles to 9 miles an hour the truck consumed approximately  $7\frac{1}{2}$  kw without load. Loaded it showed a power consumption of about 10 kw on level road, and on some of the hills climbed the power consumption rose as high as 20 kw for short intervals. It will travel through sand with comparative ease, and the only difficulty experienced has been on roads of slimy, slick mud. In one instance the driving wheels sank in this sort of mud 7 in. and the trailer went down as deep as 22 in., yet by careful manipulation the truck was successfully pulled out with its load, going over about 300 yd. of this kind of road. It is claimed that a man of ordinary intelligence may be taught in a very few days to handle the truck under the conditions met with in these regions.

# Central Station

## Management, Policies and Commercial Methods

### MORE STREET LAMPS IN FORT WORTH, TEX.

With the proceeds from a \$25,000 bond issue Fort Worth, Tex., is extending its street-lighting service. In the outlying districts of the city 250 arc lamps and 400 tungsten incandescents are being installed. North Fort Worth gets the benefit of 50 of these additional lamps, and Main Street and Houston Street in Fort Worth will have 50 more.

### ORGANIZATION OF THE MINNEAPOLIS NEW-BUSINESS DEPARTMENT.

The new-business department of the Minneapolis General Electric Company, under the management of Mr. H. J. Gille, consists of the manager, Mr. Gille; the assistant manager, Mr. R. W. Clark; two power specialists in the engineering department; one new-building man; one sign man; one general man and 10 men assigned to districts. In recruiting men for this department they are first taken into the office, where they can get familiar with the system of the company and its methods of treating the public can be seen. From the office they are sent out to district work in the new-business department. As an incentive to further efforts, they have the possibility of graduating to good positions in other Stone & Webster properties.

The man in charge of new buildings sends the company's booklet on residence wiring to every one taking out a permit for a new residence. A card for the card index is made out for that building, and these cards are given to the district solicitor for the district in which the building is located, who must follow up this building and report promptly whether the building is being wired. It is his duty to see if possible that the wiring is properly done with adequate provisions as to outlets and no delay is allowed in connection with these new-building cards. It is the company's practice to draw plans for the wiring and lighting of high-grade residences. On new residences the architect plans are employed. If it is an old residence, then new floor plans are drawn to show the location of outlets.

### MAKING SALESMEN OF CUSTOMERS.

The New London Gas & Electric Company and the three stations controlled by the Rockville-Willimantic Lighting Company, at Willimantic, Rockville and Staffords Springs, Conn., have just inaugurated a scheme of recompensing customers who effect the sale of electrical apparatus or secure a new cus-

Fig. 1—Credit Order Blank.

tom. A copy of the notice sent to customers, which explains itself, is given herewith. The general manager of the properties, Mr. Alex. J. Campbell, looks for good returns, although admitting that the success or failure of the scheme depends on whether the companies succeed in getting the people interested. In addition to the credits given, three prizes aggregating \$90 are offered by the companies in their respective territories

to the three persons who bring them the most business between June 15 and Dec. 1. Besides notices sent to customers, the

### TO OUR CUSTOMERS.

New London, June 15, 1910.

We have made a practice for some years of paying out a considerable sum of money each year to secure new business. This has been paid principally for advertising and to canvassers.

There is no class of people towards whom we feel better disposed, or to whom we would rather pay at least a part of this money, THAN TO OUR OWN CUSTOMERS.

**WE PLAN AS FOLLOWS:**

From June 1st to December 1st, 1910, whenever a customer of ours, taking gas or electricity from us, sells one of our appliances to be used on our mains, or brings us a new customer for gas or electricity, the Sales Department will give the party making the sale a credit order, on the cashiers. These orders will be accepted in the payment of bills due this Company, if presented before January 1st, 1911.

No bills will be considered made, or customer secured, until accepted by us.

**ORDERS WILL BE GIVEN AS FOLLOWS:**

FOR	Credit Order For
Each new Gas customer secured,	\$1.00
Each new Gas Range sold, - - -	1.00
Each new Gas Cooker sold, - - -	.75
Each new Water Heater sold, - - -	1.00
Each new Hot Plate sold, - - -	.40
Each new Gas Outlet, - - -	.10
Each new Gas Radiator sold, - - -	.25
Each new Electric customer secured,	\$1.00
Each new Electric Motor sold, - - -	1.00 per h.p.
Each new Electric Iron sold, - - -	.50
Each new Electric Fan sold, - - -	.50
Other Electric Appliances sold, 10 per cent. of selling price.	

To make the plan more interesting, we offer the following cash prizes for the greatest volume of new business secured, as shown by the amount in dollars of credit orders issued between June 1st and December 1st, as follows:

- To the person securing the largest total, \$50.
- To the person securing the 2d largest total, \$25.
- To the person securing the 3d largest total, \$15.

These prizes are cash and in addition to any credits obtained from our premium list.

**EMPLOYEES OF THE COMPANY WILL NOT BE ALLOWED TO PARTICIPATE.**

**NEW LONDON GAS & ELECTRIC CO.**

Fig. 2—Notice to Customers.

company is carrying large advertisements in the local papers calling attention to the plan, in which employees of the company are not allowed to participate.

### STRAIGHTENING THE LOAD CURVE AT CEDAR RAPIDS, IOWA.

Intelligent housewives, and laundry people, and tailors, and even restaurant keepers, want to use the new electrical devices because they are in every way superior to old methods, except that in some cases the apparent cost is greater. At the same time central-station managers see in them a means for improving the load factor. As most of the load furnished by these devices comes at a time when the ordinary load is low—either in the daytime, as in the use of electric irons, mangles, washers, etc., or late at night, as in charging automobile batteries—the managers get after this business as “velvet,” and in this they are being most ably seconded by the manufacturers of the devices.

It is always of interest and encouragement to central-station men to hear what their colleagues in other places are doing in this direction. A most interesting and instructive example of this is found out on the prairies of Iowa in the town of Cedar Rapids, which contains from 35,000 to 40,000 people. The Cedar Rapids & Iowa City Railway & Light Company, under

Superintendent J. C. Young, is making great strides to the front in the matter of day load.

Mr. Young has, within the last few months, secured and connected-up the very profitable load of the Douglas Starch Company's factory. This load is on 24 hours a day for six days a week, and averages throughout the 24 hours 480 kw, or more than 640 hp. This company now grinds about 5000 bu. of grain per day, and is greatly enlarging its plant, so that it will, upon

so profitable as the others mentioned, for the reason that part of it tends to sharpen rather than to smooth off the peak, yet it is sought after because it is worth much in popularizing the use of electricity.

Still another source of day load which, while rather intermittent, is nevertheless considerable, is in the electrically driven suction cleaners, of which there are 100 or more in use in the city. As these are of several sizes from 1/6 hp to 2 hp or 3

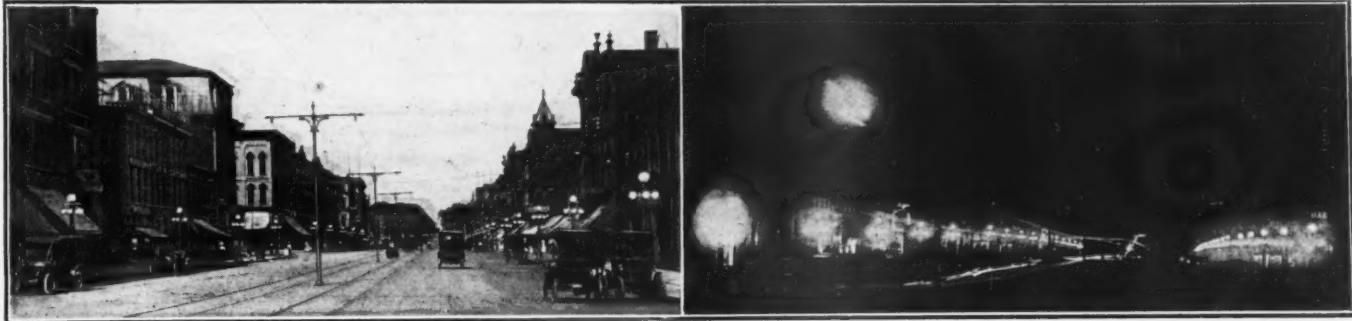


Fig. 1—Tungsten Cluster Illumination.

completion, grind daily about 15,000 bu. The machinery is all operated by three-phase induction motors drawing their energy from the central station of the Cedar Rapids & Iowa City Railway & Light Company.

In the last year the electric company has made very material gains in other directions. There are in the city about 200 factories, large and small, and Mr. Young states that about 71 per cent of the energy required for these is furnished by his central station. There are also five laundries which are equipped with electrically driven washers and mangles, and several tailor shops which are using electric irons exclusively. One restaurant also has short-order heating apparatus using 4000 watts, and this load is carried 14 hours per day. The load in electric

hp, and are in use for an hour or more every other day, it can be seen that this load is worth having, especially as it is constantly increasing.

The Cedar Rapids station under consideration has another source of revenue which is unusually large for the place, and that is in the charging of automobile batteries. The management has heartily encouraged the purchase of electric vehicles, and offered the favorable rate of 5 cents per kw-hour for charging energy, with the result that there are in the city about 25 rectifier charging stations, either in garages or privately owned. The company contemplates the establishment of a charging station of its own.

When it is considered that the charging rate of an electric



Fig. 2—Show-Window Lighting.

irons is also no mean one, when it is considered that there are several dozen of these in the shops alone, each iron requiring from 300 watts to 1000 watts, and being in use about 10 hours a day. Also the housewives of Cedar Rapids have taken favorably to the company's 30-day free trial offer of its electric irons, and there are very many in use in the homes. The load in electric cooking apparatus—toasters, warming pans, coffee percolators, etc.—is also considerable, and, although not quite

vehicle may be from 500 watts to 1000 watts, and that the charging is commonly begun after 10 p. m. and continued through the night, when the ordinary light and power load is small, it may be seen that a dozen or so automobile batteries on the circuit are worth having, especially as they require almost no wattless current. An electric vehicle may consume, therefore, from 2000 kw-hours to 11,000 kw-hours annually, about as much as 10 arc lamps.

In still another direction the management has also been quite active. In common with other central-station managements it has seen the possibilities of the tungsten lamp for getting business. Mr. Young has taken up in some detail the problem of show-window lighting. He has taken an upper room in the office building and had it fitted up as a sort of trying-out place. Black oilcloth curtains are hung in such a manner that they can be drawn so as to partition off the room into several little darkrooms, and in these divisions articles are arranged as in show windows, and tests made upon them with various sizes and positions of lamps and shades. As a direct result of this somewhat impromptu laboratory he has added to the company's business the lighting of half a dozen or more big show windows for about three hours every evening in the week on a flat rate, and the writer can testify that it would be hard to find any more attractive and pleasingly lighted show windows in Iowa. The units used are 60-watt tungstens, with prismatic glass reflectors of appropriate design. They are placed at the top of the window against the outside wall in such a position that the observer on the sidewalk will not see the lamps at all unless he takes the trouble to look directly upward. These windows belong to clothing, shoe and drug stores. The sharpness of detail and uniformity of illumination afforded have already attracted considerable comment. Some illustrations are given on page 159.

Only a few days ago Mr. Young had stepped into one of the large clothing stores to talk over a lighting proposition. The show window of this store was one of those referred to above.

"Charley," said the proprietor, "aren't you going it just a little bit strong on my window lighting?"

Before Mr. Young could answer the head clerk, who was standing near, spoke up:

"Not at all, Mr. A——. Why, I was downtown here Friday night, and there was a crowd on the streets, and our win-

dow had at least a dozen people looking at it, and it was the only one on the block which had anybody."

"Mr. A—— just grinned and said: "I guess it's all right, Charley."

The window referred to (Fig. 2, top) has a frontage of about 25 ft. on each side of the front doorway, and the lighting is given by 30 tungsten lamps, 15 on either side, each lamp of 60 watts rating, with appropriate prismatic glass reflectors. This makes a load of 1800 watts for this one window. The other windows lighted on the same scheme comprise a load of more than 3000 watts, making a total of, perhaps, 5000 watts for special show-window lighting with tungsten lamps.

Another feature which has greatly helped in building up residence service is a special contract offered to new consumers only for the limited period of May 7, 1910, to June 16, 1910. The significant paragraph in this contract is as follows:

"It is understood and agreed that if the order for connection is received and connection is made by the company at any time between May 7, 1910, and June 16, 1910, the said company will allow to the undersigned consumer the sum of nine (\$9) dollars as credit to apply on monthly bills for electric energy, provided that the said consumer was not using electric light on the said premises on or previous to May 7, 1910."

#### ASSETS AND LIABILITIES OF GREATER NEW YORK CENTRAL-STATION COMPANIES.

The New York City Public Service Commission has made a compilation of the assets and liabilities on Dec. 31, 1909, of light, heat and power companies under its jurisdiction, including gas companies. The several electrical companies in Manhattan are entered under the head of the Consolidated Gas Company as associated companies. The gas properties of the

#### I. CONSOLIDATED GAS ASSOCIATED COMPANIES.

ASSETS OR DEBIT SIDE	New York Edison Co.	United Elec. Lt. & Power Co.	Brush Elec. Illum. Co.	Ball Elec. Illum. Co.
<b>CURRENT ASSETS:</b>				
Cash	\$3,281,908	\$26,105	\$4,781	
Special deposits	97,770	263,802		
Bills receivable from associated companies		280,000		
Other bills receivable	30,275			
Accounts receivable with associated companies	63,275	5,076	7,942	
Accounts receivable with City of New York	2,201,308	282,319	171,502	
Consumers' accounts receivable	1,760,123	131,561		
Other accounts receivable	1,311,515	43,548	3,403	
Interest and dividends receivable	507,878			
Other current assets	37,774			
Materials and supplies	1,888,343	233,111		
Total floating capital	\$11,180,169	\$1,265,522	\$187,628	
<b>INVESTMENTS:</b>				
Free investments	\$9,288,031	\$50,035	\$4,567	
Bound investments	1,609,456	1,048,263		
<b>FIXED CAPITAL:</b>				
Fixed capital December 31, 1908	109,323,831	10,827,222	1,327,649	249,950
Fixed capital installed since December 31, 1908	3,834,809	374,199	14,985	
<b>MISCELLANEOUS TEMPORARY DEBITS:</b>				
Prepayments	7,774	356		
Unamortized debt discount and expense	37,212			
Other suspense	8,860	8,190	9,643	
Corporate deficit		826,240	184,060	566
Grand Total	\$135,290,142	\$14,400,027	\$1,698,562	\$250,516
<b>LIABILITIES OR CREDIT SIDE</b>				
<b>UNFUNDED DEBT:</b>				
Taxes accrued	\$3,362,458	373,175	34,992	
Judgments unpaid				
Interest accrued on funded debt	588,477	1,203,300		
Interest accrued on unfunded debt	182,500	129,214		
Dividends declared				
Bills and accounts owing to associated companies	14,220,012	1,437,480	346,086	
Miscellaneous bills payable				
Consumers' deposits	246,165	61,870	130	
Miscellaneous accounts payable	723,611	166,420	752	516
Other unfunded debt	276,322			
Total unfunded debt	\$19,599,545	\$3,371,459	\$381,960	516
<b>FUNDED DEBT:</b>				
Mortgage bonds	\$43,417,884	\$4,838,000	\$275,000	
Miscellaneous funded debt	662,512			
<b>RESERVES:</b>				
Premiums on stocks, etc.				
Renewal and contingency account	9,143,500	829,374	38,035	
Accrued amortization of capital				
Unamortized premium on debt	220,304			
Casualties and insurance reserve	148,489	42,697	4,567	
General suspense	86,784	63		
Capital stock	45,080,671	5,318,434	999,000	250,000
Corporate surplus	16,930,453			
Grand Total	\$135,290,142	\$14,400,027	\$1,698,562	\$250,516

II. BROOKLYN COMPANIES.

ASSETS OR DEBIT SIDE	Kings Co. Lighting Co.	Amsterdam El. Lt. H. & Power Co.	Edison Elec. Ill'g Co. of Brooklyn	Kings Co. El. Lt. & Power Co.
<b>CURRENT ASSETS:</b>				
Cash	\$268,443.96	\$226.84	\$98,342.83	\$6,692.16
Special deposits	102,025.00		97,856.25	196.00
Bills receivable	1,000.00		3,724.74	
Advances to Associated Companies			46,881.97	7,712,249.90
Accts. receivable with City	33,025.24		159,042.00	
Consumers' accounts receivable	80,185.70		308,322.43	
Other accounts receivable	10,716.82		16,550.80	
Interest and dividends receivable		2.70	182,742.11	14,077.43
Other current assets			709,698.96	
Materials and supplies	28,698.61			
<i>Total floating capital</i>	\$524,095.33	\$229.54	\$1,623,162.09	\$7,733,215.49
<b>INVESTMENTS:</b>				
Free investments				
Bound investments			582,773.22	6,175,870.00
<b>FIXED CAPITAL:</b>				
Fixed capital December 31, 1908	\$4,936,055.74	\$38,417.90	\$16,040,497.39	\$4,603,175.08
Installed since December 31, 1908	116,006.58		(b) 1,165,286.68	326,339.55
<b>MISCELLANEOUS TEMPORARY DEBITS:</b>				
Prepayments	1,164.81		769.78	
Unamortized debt discount and expense			491,128.92	93,333.24
Other suspense			3,121.63	
Corporate deficit		991,617.63		
<b>Grand Total</b>	<b>\$5,577,322.46</b>	<b>\$1,030,265.07</b>	<b>\$19,906,739.71</b>	<b>\$18,931,933.36</b>
<b>LIABILITIES OR CREDIT SIDE</b>				
<b>UNFUNDED DEBT:</b>				
Taxes accrued	\$10,114.04	\$659.98	(b) \$185,089.15	
Judgments unpaid				
Interest accrued on funded debt	111,400.00	182,075.00	201,846.25	
Interest accrued on unfunded debt			861.15	
Dividends declared				\$196.00
Due associated companies		46,881.97	7,712,249.90	
Miscellaneous bills payable			742,210.00	
Consumers' deposits	83,333.38		85,922.99	
Miscellaneous accounts payable	17,616.73		481,598.29	
Other unfunded debt	6,885.48		36,704.89	
<i>Total unfunded debt</i>	\$229,349.63	\$229,616.95	\$9,446,482.62	\$196.00
<b>FUNDED DEBT:</b>				
Mortgage bonds	\$2,553,000.00	\$300,000.00	4,275,000.00	\$7,676,000.00
Miscellaneous funded debt	250,000.00			
<b>RESERVES:</b>				
Premium on stocks, etc.				10,542.00
Renewal and contingency account			5,549.47	
Accrued amortization of capital	18,192.84		430,260.74	
Casualties and insurance reserve			182,303.51	
Other optional reserves		648.12	(c) 567,143.37	
Capital stock	2,000,000.00	500,000.00	5,000,000.00	10,000,000.00
Corporate surplus	526,779.99			1,245,195.36
<b>Grand Total</b>	<b>\$5,577,322.46</b>	<b>\$1,030,265.07</b>	<b>\$19,906,739.71</b>	<b>\$18,931,933.36</b>

III. MISCELLANEOUS.

ASSETS OR DEBIT SIDE	Consolidated Tel. & Elec. Subway Co.	Empire City Subway Co., Ltd.	Long Acre Elec. Lt. & Power Co.	Bronx Gas & Electric Co.	Queens Borough Gas & Electric Co.	New York & Queens Elec. Lt. & Power Co.	Bowery Bay Elec. Lt. & Power Co.	Richmond Light & R. Co.
<b>CURRENT ASSETS:</b>								
Cash	\$36,715.42	\$24,032.57	\$3,174.13	\$73,126.29	\$24,779.43	\$54,610.85	\$87.30	\$32,594.60
Special deposits						1,950.00		44,840.00
Accts. receivable with Ass'd Cos.	51,499.97							13,680.73
Accts. receivable with City of N. Y.				20,878.54	30,502.60	73,060.31		156,061.14
Consumers' accounts receivable		230,422.52		27,878.66	33,631.84	21,975.34	7,498.66	19,773.31
Other accounts receivable	133,764.58	26,467.18	286.63	6,619.26	3,130.20			7,665.84
Other current assets				991.94				
Materials and Supplies	44,012.37	46,133.10	1,260.44	28,894.97	24,397.19	27,537.44	1,991.93	51,799.43
<i>Total floating capital</i>	\$265,992.34	\$327,055.37	\$4,721.20	\$158,389.66	\$116,441.26	\$179,133.94	\$9,577.89	\$324,615.05
Investments (free)			500,000.00			7,500.00		445,000.00
<b>FIXED CAPITAL:</b>								
Fixed capital Dec. 31, 1908	\$13,817,373.91	\$11,290,541.75	\$90,736.10	\$1,019,265.88	\$4,021,323.91	\$5,166,343.26	\$229.29	\$4,884,775.08
Fixed cap. inst. since Dec. 31, '08								
—elec.	1,368,944.78	392,982.40	897.21	68,044.57	75,709.20	111,885.43		(e) 17,782.29
Fixed cap. inst. since Dec. 31, '08								
—gas				25,589.24	50,210.59			
<b>MISCELLANEOUS TEMPORARY DEBITS:</b>								
Prepayments		1,451.03		3,445.31	3,093.76	3,555.82		8,300.25
Unamortized debt disc't and expense			6,515.93			590.32		
Other suspense			(b) 2,139.54	17,754.48	409.02		1,000.00	12,896.20
Corporate deficit			130,193.64				6,571.59	124,739.14
<b>Grand Total</b>	<b>\$15,452,311.03</b>	<b>\$12,012,030.55</b>	<b>\$735,203.62</b>	<b>\$1,292,489.14</b>	<b>\$4,267,187.74</b>	<b>\$5,469,008.77</b>	<b>\$17,378.77</b>	<b>\$5,818,108.01</b>
<b>LIABILITIES OR CREDIT SIDE</b>								
<b>UNFUNDED DEBT:</b>								
Taxes accrued	\$582,547.41	\$156,388.13	\$3,460.11	\$25,874.95	\$8,533.04			\$80,495.93
Judgments unpaid								
Interest accrued on funded debt	370,015.25	12,500.00	34,166.68	13,025.00	6,371.39	\$48,983.33		44,840.00
Interest accrued on unfunded debt	(a) 113,557.50		383.33	120.00	579.17	375.03		
Dividends declared				325.00				
Bills & accts. owing to ass'd Cos.	383,009.62		5,723.16					41,629.01
Miscellaneous bills payable—demand			64,150.80	10,000.00	70,000.00			69,000.00
Miscellaneous bills payable—time				75,000.00		250,000.00		399,000.00
Consumers' deposits	90,747.45	276,354.21	77,319.54	26,589.58	23,888.18	18,108.06	1,180.56	4,742.50
Miscellaneous accounts payable	3,005.43			25,264.92	36,988.29	53,423.33	12,698.21	70,952.85
Other unfunded debt				10,025.29	987.46			4,424.55
<i>Total unfunded debt</i>	\$1,542,882.66	\$445,242.34	\$185,203.62	\$186,224.74	\$147,347.53	\$370,889.75	\$13,878.77	\$715,084.84
<b>FUNDED DEBT:</b>								
Mortgage bonds	\$2,935,000.00	\$6,893,000.00	\$500,000.00	\$500,000.00	\$2,017,500.00	\$2,338,000.00		\$2,200,000.00
Miscellaneous funded debt	8,895,000.00			30,100.00				
<b>RESERVES:</b>								
Contractual reserves					32,406.73			
Renewal and contingency account		17,000.00		17,228.23				
Accrued amortization of capital				3,427.67	44,359.33	59,809.15		13,004.40
Unamortized premium on debt								
Other required reserves						425.79		
Casualties and insurance reserve								
Other optional reserves						930.00		18,268.77
Capital stock	1,875,000.00	4,393,000.00	50,000.00	486,500.00	2,000,000.00	2,500,000.00	3,500.00	2,871,750.00
Corporate surplus	204,428.37	263,788.21		69,008.50	25,574.15	198,954.08		
<b>Grand Total</b>	<b>\$15,452,311.03</b>	<b>\$12,012,030.55</b>	<b>\$735,203.62</b>	<b>\$1,292,489.14</b>	<b>\$4,267,187.74</b>	<b>\$5,469,008.77</b>	<b>\$17,378.77</b>	<b>\$5,818,108.01</b>

Consolidated Company represent total assets of \$235,198,000, the figure for its associated electrical companies being \$151,639,000, which latter represents practically the entire amount of Manhattan central-station assets.

## Wiring and Illumination

### ARCH LIGHTING IN OWEN SOUND, ONT.

In Owen Sound, Ontario, Canada, some street arch lighting was undertaken primarily for the purpose of advertising the town, and it has attracted so much attention and has proved so satisfactory that the system is to be extended. The original installation consisted of 20 arches made of iron tubing spanning the main street and placed 35 yds. apart. Each arch carries 21 8-cp, 200-volt carbon lamps spaced 24 in. These are arranged three in series, as the distribution voltage of the town is 600 volts. It is stated that the cost of each arch complete, including lamps, was \$20, and the cost of operation is placed at 4 cents per hour per arch. Ten more arches are to be erected at once.

### UNDERGROUND DISTRIBUTION IN TORONTO.

The underground distribution system, which is now in course of construction in Toronto, Ontario, will take care of the block of electrical power to be delivered to that city by the Hydro Electric Power Commission of Ontario. The power will be received from the high-tension lines at the main terminal station and thence distributed, partly underground and partly overhead, to six different substations throughout the city, including one in West Toronto. The ducts which are to contain the cables rest on a bed of concrete 4 in. thick, each duct being enclosed in 3 in. of concrete. The minimum distance from road level to top of duct is 34 in. Manholes are located at intervals of approximately 300 ft., and are placed at street intersections where possible. They are of brick construction with a concrete roof, in which a cast-iron frame supported by I-beams is set to carry the covers. Each manhole is drained by a connection to the sewer. Three-conductor cables are being installed.

### LARGE ELECTRIC SIGN IN CHICAGO.

The accompanying illustration shows an interesting electric sign on the roof of a building on Michigan Avenue, Chicago, which attracts the attention of automobilists and others pass-



Double-Faced Speedometer Sign.

ing in either direction on that thoroughfare. The sign is double-faced, and represents the dial of a speedometer designed for use on automobiles. The flasher operates the two sides

alternately, so that the number of lamps burning at one time is only one-half of the total installed.

The indicator of the sign swings across the face of the dial from zero to the highest speed—60 miles per hour. It is outlined by electric lamps closely set together so that the eye can easily follow its motion over the scale.

In the illustration the concentric arcs are the effect upon the photographic plate of the moving pointer.

### ELECTRICAL DECORATIONS FOR THE TRIENNIAL CONCLAVE OF THE KNIGHTS TEMPLAR IN CHICAGO.

Elaborate preparations are under way for the thirty-first triennial conclave of the Grand Encampment of Knights Templar of the United States, which will be held in Chicago during the week of Aug. 8 to 13. The conclaves of the Knights Templar are affairs of great magnitude, and it is estimated that the number of Sir Knights, with the members of their families and other visitors, who will come to Chicago for the occasion may be as high as 100,000. Naturally very careful and thorough preparations must be made to shelter and care

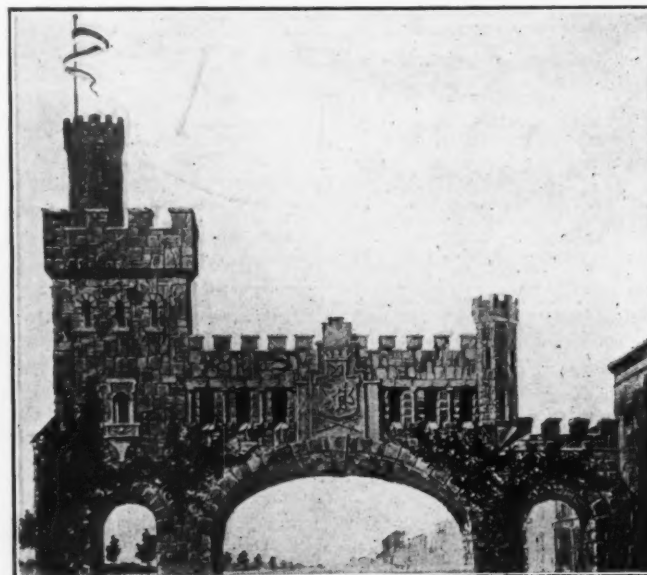


Fig. 1—Entrance Arch, Michigan Boulevard.

for this multitude. The city will be in gala attire, and the electrical decorations will be unique and interesting.

An "entrance arch" in imitation masonry and of castellated architecture, will span Michigan Boulevard, near Park Row. This will be outlined in electric lamps and the "windows" in the structure will be illuminated at night to give the effect of rich stained glass. The design of this arch is shown in Fig. 1.

At La Salle and Madison streets will be erected a "grand commandery arch" of pleasing design, as shown in Fig. 2. This will be profusely decorated and illuminated by electricity and be an attractive feature of the street display.

State Street, from Lake Street to Van Buren Street, will be transformed into "The Templar Way." Columns will be erected at frequent intervals along the curb and between them, longitudinally, will be festoons of real laurel. The columns will be surmounted by star-studded globes, and the stars will be outlined in electric lamps. The festoons of laurel will also be entwined with green incandescent lamps. Various emblematic designs will be shown along "The Templar Way," as indicated in Fig. 3, and these emblems will bear electrical decorations in various-colored lamps.

But the crowning feature of the electrical decorations will be an immense spectacular reproduction of the official badge of the conclave. This will be possibly the largest spectacular sign ever built, as it will be 135 ft. in height above grade and 64 ft.

across the word "Welcome" at the base. This electric badge will be erected on Grant Park, south of the Art Institute and facing Jackson Boulevard. Fig. 4 is a reproduction of a photograph showing the design of this electric spectacle. The incandescent lamps do not show in the picture, but actually there will be about 4400 4-cp tungsten lamps in red, white, blue, yellow and purple, bringing out the various features of the design.

Some of the dimensions of this enormous spectacle are of interest. The helmet at the top is 7½ ft. high and 6 ft. wide.



Fig. 2—Grand Commandery Arch, La Salle Street, Near Madison.

That part of the emblem containing the crossed swords is 40 ft. in width by 28 ft. in height. The letters in the words "Chicago 1910," are 3 ft. high. The letters "K" and "T" are 6 ft. high and the letters in the words "31st Triennial Conclave" are 2 ft. high. The sword hilts are 8 ft. in length by 2 ft. in width and the sword points are 5 ft. in length by 2 ft. in width. The eagle in this part of the emblem is 12 ft. from tip of bill to end of wing. The shield below the eagle is 5 ft. in height and the ribbon in the mouth of the eagle is 10 ft. long.

The middle portion of the emblem representing the mounted knights and with the words "Grand Encampment of the U. S." is 32 ft. wide and 22 ft. high. From the top of each knight's head to the bottom of the horses' hoofs is 16 ft.

At the bottom of the badge is the third portion of the emblem, being the Knights Templar emblem. This portion of the

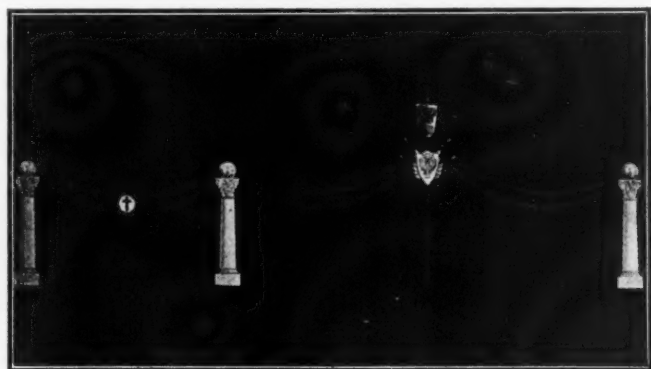


Fig. 3—Side Decorations, The Templars' Way, State Street.

sign is 38 ft. high by 35 ft. wide. The cross in the center is 10 ft. high and 6½ ft. wide. The letters in the word "Welcome" at the bottom of the sign are 10 ft. in height. The entire emblem will be studded with tungsten lamps, and it is interesting to note that in no portion of it will the lamps be farther apart than a distance of 6 in.

Work has been started on the construction of this emblem. The framework for the sign will be of steel set on concrete foundations. An elaborate flashing scheme has been devised, and there will be three separate flashers mounted on the struc-

ture, each carrying one of the three parts of the emblem. All three of these flashers will be controlled and operated by a master flasher set at the bottom of the sign. The operation of the sign will be as follows:

The word "Welcome" at the bottom is steady-burning, the lamps here being red. The upper part of the emblem flashes on first. Simultaneously with the flashing of this part of the emblem the circle of lamps around the eagle and shield and the circle of lamps around the letters "K" and "T" revolve. The lamps in the ribbon in the mouth of the eagle give a waving effect to the ribbon.

The second or middle section of the emblem flashes on very rapidly after the first section, and simultaneously the horses' feet of the mounted knights are seen in motion, giving the effect of the pawing of impatient steeds. Quickly following is the flashing on of the third or lower section. The "moving" effect in this section is attained by the flashing of the jewels in the crown surrounding the cross. These jewels "sparkle" electrically. After the third section is flashed on, all of the lights in the entire emblem are flashed off together. Then all the lights in the emblem are flashed on together and remain burning for a short time, after which all the lights in the entire



Fig. 4—Electric Sign Representing Official Badge of Knights Templar Conclave.

design are again flashed off, and then the cycle of operation described is repeated.

In carrying out the construction of this electric spectacle 10½ tons of steel will be needed for the framework. The concrete piers are 6 ft. square and 18 ft. deep. Double-braid, rubber-covered wire will be used for the wiring, and 18,000 ft. of it will be required.

This great electric spectacle was planned by Mr. Gorham B. Coffin, chairman of the decorations and electric display committee for the conclave, and Mr. S. W. Van Nostrand, of the Thomas Cusack Company, which company has in charge the designing, construction and operation of the sign. Electricity will be obtained from the Commonwealth Edison Company.

## NEW TELEPHONE PATENTS.

### NEW APPARATUS.

There have been designed a large number of gong-ringing keys in which the key plungers indicate by their positions which key was last operated.

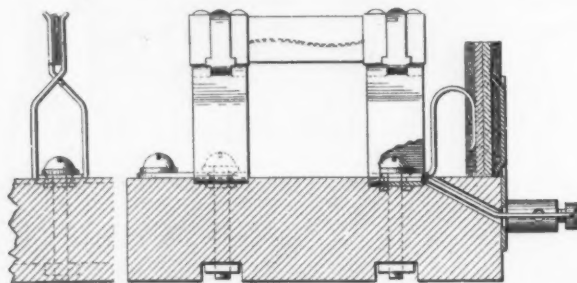
Mr. L. A. Williams, of Evanston, Ill., has designed a key in which this indication involves the push button only, the key plunger having no intermediate position. The push is mounted upon a sleeve which travels upon the spindle of the key plunger.

A spiral spring keeps the push normally at the top of the spindle. When the push is depressed, this spring is compressed and the sleeve travels down the spindle to the indicating position. Then, with further travel, it drives the key plunger to operate the key. Upon release of the pressure, the key plunger returns to normal position, while the key push returns to indicating position, a tooth upon the sleeve engaging a retaining plate. If any other push be depressed the retaining plate will be tilted to release any push locked down. The Stromberg Carlson Company has been assigned this patent.

B. W. Sweet, of Cleveland, has obtained a patent for a hook switch. This is of the removable lever type and the present invention relates to the means of securing the lever in its socket. The socket is of the same section as the lever and when this lever is pushed home, a pin, carried by the lever, engages notches in the socket. As the pin goes into the slot, one end engages a perforation in a slip spring which locks the lever in the socket. To release the lever it is necessary to pry the spring away from the pin.

Another removable lever desk stand is that described in a patent granted to C. T. Mason, of Sumter, S. C., and assigned to the Sumter Telephone Manufacturing Company. This is a departure from the conventional stand, as the transmitter mounting springs from the side of the stem tube. This leaves the upper end of the stem tube to be capped. In this case the cap is part of a plate carrying the hook switch parts. It will thus be seen that the cap, the plate and the hook switch may be together withdrawn from the stem tube without disturbing the transmitter or its wiring. The patent of W. Kaisling, of Chicago, relates to a wall set and the method of mounting thereon the sending dial of an automatic system. The set takes one of the standard forms, having a back board with transmitter arm at the top and a slanting shelf near the bottom beneath which is a box concealing the other working parts. In this case the dial apparatus is mounted upon the shelf and this shelf is made to slide off in a way to clear the sending mechanism. The patent for this set is assigned to the Kellogg Switchboard & Supply Company.

The illustration shows a section of a protector invented by R. H. Manson, the Dean Electric Company having obtained the patent by assignment. The special feature lies in the spring



Manson Protector.

clips for holding the fuses. It will be noted that a very strong and positive pressure may be obtained due to the long legs of the springs and their crossed arrangement.

#### DESK STAND HEAD.

A new type of transmitter clamping head has been devised by Mr. N. Pedersen, of Genoa, Ill., his patent having been assigned to the Cracraft-Leich Electric Company. The desk stand stem terminates in a button-like piece mounted edge-wise, its plane being vertical. Two ears are pressed from sheet metal, which, when placed side by side, form a transmitter support. At the front end, the abutting ears form a disk, half being integral with each ear. Over this is slipped a flanged cap. The mounting is then held by screws passing from within the transmitter casing through the cap piece and into the ear disk.

At the other end, the ears are dished so as nearly to enclose the button-like head of the stem of the stand. Spring washers are placed on either side and a clamping bolt is used

to draw all parts together with proper friction. The angular motion of the transmitter is limited, as the flanges of the ears must be cut away to pass the neck of the stand. The extent of the cut in the flanges determines the limits of motion of the transmitter.

#### TRUNK CIRCUIT.

Mr. W. W. Dean has patented and assigned to the Dean Electric Company a trunk circuit. In arranging for the control of the distant supervisory relay from the substation plugged by the trunk, he employs a limit resistance. This resistance is in series with the disconnect relay before the called subscriber answers, at which time the disconnect relay operates in response to current received from the distant connecting cord circuit. Thus the disconnect lamp is cut off. However, the supervisory relay in the connecting cord fails as the current is insufficient. When the called subscriber answers, a relay straps out the control or limit resistance, whereupon the "A" supervisory relay receives an increased current and responds.

## LETTERS TO THE EDITOR.

### Illumination from Extended Lighting Sources.

To the Editor of *Electrical World*:

SIR:—In your issue of July 14, Mr. Carl Hering points to the omission of certain details from a letter by me which appeared in your issue for June 30. A review of my letter should convince any one that no attempt was made by me to submit an exhaustive treatise on illumination or to instruct the uninformed concerning the laws of physics and mathematics, but merely to direct the attention of the designing illuminating engineer to a method of calculation not now in common use.

Mr. Hering gives a definition for the "solid angle," and employing this "solid angle" in the method outlined by me, in which use is made of the mathematical solid angle, finds some inaccuracy and at once concludes that the method discussed by me involves quantities which I said could be neglected. The fact of the matter is that Mr. Hering has improperly defined the solid angle as the "window area in square feet divided by the square of the distance from the illuminated plans in feet." Only in the case of area on the interior of a sphere and distance measured from the center of the sphere could his definition be considered as accurate.

Doubtless Mr. Hering had in mind only the case where the illuminating area is small in comparison with the square of the distance from the point, and is perpendicular to the line joining the point and the plane. In this case the use of the solid angle defined by Mr. Hering involves no appreciable error, but under all other conditions the results must be modified, as stated by Mr. Hering, by including those factors which I claimed could be neglected. However, by employing the real mathematical solid angle, the method mentioned by me will give absolutely accurate results, within the range of accuracy of the well-known cosine law, without involving any modifying corrections whatsoever. The inaccuracies "at points near the window" which exist when use is made of the Hering solid angle disappear when the mathematical solid angle is employed.

The solid angle defined by Mr. Hering is not without merit in many problems where its simplicity is sufficient compensation for its minor inaccuracies. However, one should not assume that the determination of the true solid angle involves great difficulties. It may be noted that in the case of a plane circular source, or a source the visual projection of which can be treated as equivalent to a circular plane, the mathematical solid angle (expressed in sphere units) is equal to one-half of the versed-sine of the plane angle subtended by the radius of the source when viewed from the point under consideration. When expressed in steradian units (as tacitly implied by Mr. Hering's treatment) the result will be  $2\pi$  times the versed-sine of the angle indicated.

In view of the many recent publications dealing with the



illumination from extended lighting sources, including the Illuminating Engineering Society paper of which Mr. Hering was the author, it seems hardly necessary to state that the light flux density at the illuminated object bears to that of the illuminating plane the ratio of the mathematical solid angle to the solid angle covered by a hemisphere.

From the facts presented above it should be evident that by multiplying the light flux density of the illuminating surface (in any chosen units) by the versed-sine of the mean-half plane-angle subtended by this surface, when viewed from the point under consideration, one ascertains immediately the flux density at this point—expressed in the illumination units just selected.

Since the solid angle serves merely as a ratio in the solution of problems relating to extended surface lighting sources, the omission of any mention of the units in which the surface brilliancy, or light flux density, of the lighting plane and illuminated point were expressed, seems hardly sufficient to justify the characterization of my statement as being of the "bob-tail" kind.

Richmond, Va.

JOSEPH THOMPSON.

**Economy of Car Operation.**

To the Editor of *Electrical World*:

SIR:—In your issue of July 7, 1910, page 38, appears an abstract of the discussion of my paper on "Economy of Car Operation," read at the White Mountains A. I. E. E. convention, in which it is reported that Mr. N. W. Storer and Mr.

H. St. Clair Putnam disagreed with me in relation to the energy saving and reduction in tractive resistance of a car with anti-friction bearings.

In my reply to this discussion, which is not reported, I again pointed out that the object of my paper was to show quantitatively the value of coasting in terms of change in average speed and running time, and also to make special reference to the value of anti-friction bearings, in contrast to referring only to the value of anti-friction bearings on street cars.

One diagram in the paper (Fig. 7) shows the effect of slight increases in running time upon the possible increased coasting and consequent saving in energy with an ordinary plain-bearing car. This is followed by an analogous diagram (Fig. 8), upon which similar curves have been superimposed upon the plain-bearing car curves for ball-bearing cars, by which means the advantage of the ball-bearing car over the plain-bearing car (for equal conditions of acceleration, braking and running times) can be compared. In conclusion the economies that are derived from coasting were specified and it was added that all these advantages can be appreciably augmented by the use of anti-friction bearings, in contrast to the inference that all these advantages have been claimed for ball bearings.

The published statement by Mr. Putnam that a possible reduction in tractive resistance of 8 lb. per ton by the use of ball bearings was claimed seems to be a typographical error; since he remarked that the claim made by the author (of about 6 lb. per ton) was too high. This amount is the result of tests made on the Atlantic City & Shore Railroad and recorded in the paper.

Philadelphia.

CYRIL J. HOPKINS.

**Digest of Current Electrical Literature**

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

**Generators, Motors and Transformers.**

*Electromagnetic Theory.*—H. ZIPP.—The author attempts to simplify the theory of all kinds of apparatus in which electric energy transformation occurs by means of magnetic fluxes, so that all the different apparatus may be considered from one and the same viewpoint. All apparatus for the transformation of electrical energy can be reduced to the same "fundamental type" which is best represented by the induction motor. In every special case there is a combination of a primary magnetomotive force with a secondary magnetomotive force. These two magnetomotive forces, together with the resulting magnetomotive force, when represented by graphical methods, form a triangle. This triangle of the magnetomotive forces defines completely the condition of operation of any apparatus in which energy is transformed. All such apparatus is considered under the supposition that the primary as well as the secondary is rotary. The author first discusses the "fundamental form of electromagnetic energy transformers" and then takes up the discussion of direct-current machines and synchronous alternating-current machines for single-phase and polyphase currents, transformers and non-synchronous machines.—*Elek. und Masch.* (Vienna), June 19 and 24, July 3.

*Small Direct-Current Machines.*—G. I. STADEKER.—In a continuation of his illustrated serial on the windings of dynamo-electric machines the author deals with small direct-current machines and first discusses wire-wound threaded-in coils for machines with partially-closed slots and then takes up open-slot windings.—*Elec. Jour.*, July.

**Lamps and Lighting.**

*Metallic-Filament Lamps and Central Stations.*—W. A. TOPPIN.—The author argues that the large demand for metallic-filament lamps benefits chiefly the inventors and German manufacturers. He thinks that the British central-station engineer and British manufacturer would be more benefited by counteracting the tendency of buying metallic-filament lamps and the author thinks this can be done by a suitable tariff. In Fig. 1

the curves *ABC* give the cost of lighting as a function of the life for a certain energy rate and the curves *DEF* give the cost of lighting for another energy rate. *A* and *D* are 32-cp carbon lamps costing 31 cents and consuming 4 watts per candle-power, curves *B* and *E* relate to 32-cp tantalum lamps costing 87 cents and consuming 1.7 watts per candle-power, and curves *C* and *F* relate to 32-cp osram lamps costing \$1.06 and consuming 1.25 watts per candle-power. The curves *A*, *B* and *C* represent the cost in pence per hour (1 penny = 2 cents) to the consumer, according to the life and type of lamp used, he being charged on the ordinary flat scale of so much per kw-hour. Lamps of different types, but of equal candle-power, are dealt with, and the prices mentioned are for lamps suitable for 250 volts. The charge per kw-hour has been taken at 8 cents as representing an average figure for large and small towns. It will be seen from a comparison between the curve *A* and the curves *B* and *C* that there is every

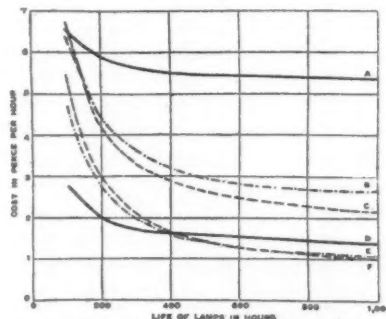


Fig. 1—Cost and Life of Incandescent Lamps.

inducement for the consumer to use metallic-filament lamps. On the other hand, the curves *D*, *E*, *F* show the cost in pence per hour for lamps of the same types as before mentioned, of equal candle-power, but the energy is charged for at only 2 cents per kw-hour. It will be seen that a carbon lamp is most economical up to a life of 400 hours and above that

point the saving by using the new lamps is not great. As the high-voltage metallic-filament lamp does not burn equally well in all positions, and does not withstand frequent handling or much vibration, the consumer will prefer the carbon lamp that has not these defects. Of course, in this case, it would be necessary to charge a fixed rate in addition to the charge for energy. This additional charge may be based on the rental of the house, on the number of lamps installed, on the probable maximum demand, or the actually ascertained maximum demand according to the readings of an indicator or recording ammeter. The last-mentioned method is the most scientifically correct, but the most difficult to work in actual practice, especially as it encourages the consumer to install as many metallic-filament lamps as possible in order to reduce his maximum demand. If the charge is based on the rental of the house, the number of rooms, or the number of lamps, then it is immaterial to the consumer what kind of lamp he uses. The author recommends one of these latter systems.—*Lond. Elec. Rev.*, July 1.

#### Generation, Transmission and Distribution.

**Frictionless Magnetic Worm Gear.**—J. Lecoche has formerly devised a frictionless magnetic worm gear in which the worm and wheel run out of contact with a clearance of about  $1/32$  in. The worm is provided with a magnetizing coil, and a magnetic circuit is arranged through the teeth so that the whole of the power is transmitted by means of the flux passing from worm to wheel. The motor or other source of power is coupled to the worm, and so long as the torque does not exceed the magnetic pull between the teeth, the gear runs synchronously. This has now been modified, the driving motor being combined with the worm, so that the motor flux serves also the purpose of transmitting the torque. This arrangement effects a saving in that the additional field for the gear is dispensed with. This driving gear is especially suitable for machine tools, compressors, air pumps, and other low-speed machines. Fig. 2 is

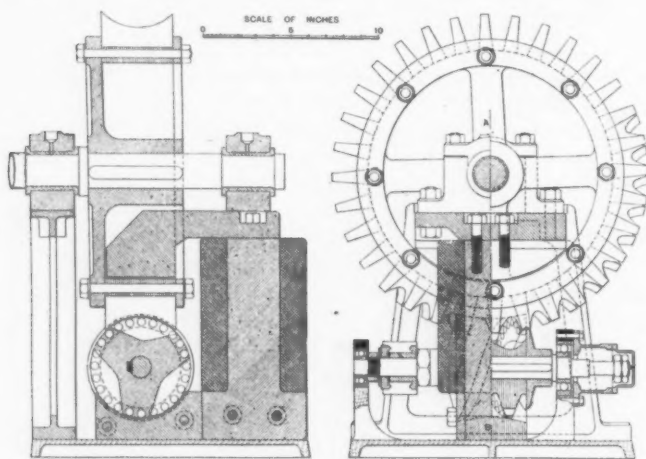


Fig. 2—Details of Combined Motor and Worm Gear.

a diagrammatic sketch of the gear. The worm is built up of a number of star-shaped laminations successively displaced so that the projections form the teeth of the worm. Slots are cut parallel to the axle, and the armature thus formed is wound and provided with a commutator. Semi-enclosed slots are used in order to avoid further decreasing the useful armature surface, which consists of the top surface of the teeth of the worm only. The motor illustrated is a two-pole machine with one pole under the armature. The worm-wheel is built up of laminations displaced so as to give the same pitch, and the second pole of the motor projects over the inner periphery of this wheel. The path of the flux is thus through the rim of the worm-wheel and the armature in series. The gap between the upper pole and the worm-wheel rim need only be very small. The worm-wheel is cut concave, so as to envelop the armature. The magnetic pull on the worm-wheel rim is practically balanced, and the only losses in the gear are the small friction losses in the ball bearings, the losses in the motor, and

a very small hysteresis and eddy-current loss in the teeth of the worm-wheel. In the example illustrated, the worm is a 200-volt armature running at 1850 r.p.m. and the worm-wheel runs at about 175 r.p.m., the ratio being 32 to 3. There is no friction at the teeth, and no wear. The combined gear is claimed to be both more efficient and cheaper than an ordinary high-speed motor coupled to a machine-cut worm gear, and runs noiselessly. It starts up under load, but once the wheels have fallen out of synchronism, the worm-wheel stops and the motor has to be stopped and started up again. If all the load is taken off, however, the worm-wheel can be run up to speed without stopping the motor. The motor cannot be overloaded, as the wheels will drop out of step whenever the torque exceeds the magnetic pull between the teeth. The combination is reversible and Lecoche has designed a generator on the same principle to be driven by low-speed engines. In this case, the flywheel of the gas or other engine is provided with a laminated iron rim, the teeth of which mesh magnetically with the generator armature, the latter being constructed in exactly the same manner as described above in connection with the motor.—*Lond. Elec. Eng'ing*, June 30.

**Coal Cutters.**—A discussion of the relative advantages and disadvantages of the electric and compressed air drive for coal-cutting machines. The principal advantages of the electric drive are its very much high efficiency and greater flexibility of the transmission line; the principal disadvantage is danger from shock. The principal advantage of compressed air is safety. Finally, reference is made to the method of compressing air by electric motors near the face, using the compressed air to drive coal-cutting and drilling machines on the face. This method has several important advantages. The efficiency is not as high as the purely electrical method, the difference being as from 62 to 70 as compared with 80, under similar conditions. The difference is not serious, considering the advantages obtained by the method of electrically compressing the air. The weak point of the ordinary compressed-air system, the pipe line, is practically eliminated.—*Iron and Coal Trades Review*, July 1.

**Electric Installations at Collieries.**—F. ANSLOW.—A paper read before the Mining Institute of Scotland on the electric installations in collieries, with special reference to the relative advantages of the three-phase and direct-current systems. He concludes that occasionally instances are found ideally suited to one or the other system, but more frequently it is necessary to weigh carefully the conflicting conditions and to select the system which would result in the best scheme as a whole, keeping in view that safety, reliability, economy in working, and reasonable first cost are the desirable objects.—*Iron and Coal Trades Rev.*, July 1.

**Electricity Rules for Collieries.**—Three sets of rules enforced at the Estwood collieries in England, one set being for authorized persons in charge of electric generating plants at pit tops, the second for authorized persons in charge of electric plants at pit bottoms, and the third for persons in charge of coal-cutting machines.—*Iron and Coal Trades Rev.*, July 1.

**Traveling Crane for Foundries.**—W. FRANZISKET.—An illustrated description of an electric traveling crane for foundries the speed of which can be regulated within very wide limits. The principle of the Ward-Leonard control is made use of.—*Elek. Kraft. u. Bahnen*, June 24.

**Load Fluctuations.**—A. REISSER.—With reference to a recent article on electric systems of main shaft winding and rolling mill driving, the author discusses the method of equalizing the fluctuations of load by a new method of Brown, Boveri & Company.—*La Lumière Elec.*, June 25.

#### Traction.

**Electrification of Lapland Railways.**—The Swedish Riksdag accepted the Government proposal for the construction of a large hydroelectric station at the Porjus Falls in the Great Lule River for the purpose of introducing electric traction on the important Lapland railways as well as for the electrification of the line itself. The State holds undisputed rights to falls, representing, at low water, some 70,000 turbine horse-power, which

a regulation of the lakes in Great Lule River will increase to a total of 300,000 turbine horse-power. For railway traffic, according to a load diagram drawn out by the railway department, with an iron-ore transport of 3,850,000 tons and the requisite passenger trains, an average effect of about 10,600 turbine horse-power will be required, taken as an average during 18.5 hours, out of the 24, with a maximum of 12 ore trains and two passenger trains in each direction. The maximum power required for railway traffic has been put at 23,600 turbine horse-power, wherefore, it is proposed to install for railway traffic two 12,500-hp units. For industrial purposes, two units each of 12,500 hp will be employed. The two turbines for traction will drive single-phase generators. The two turbines for industrial purposes will drive three-phase generators. Further, there will be installed, as a reserve, a fifth turbine unit, also of 12,500 hp, partly for single-phase and partly for three-phase current generation. For this purpose one single-phase and one three-phase generator are to be mounted on the same turbine shaft constituting the reserve. The generator e.m.f. is to be transformed for the single-phase systems to 80,000 volts and for the three-phase system to 70,000 volts.—*Lond. Engineering*, July 1.

**Gasoline-Electric Omnibus.**—An illustrated description of the new Daimler gasoline-electric omnibus, the principal features of which are the use of gasoline and electric motors in the form of detachable units, the abandonment of the usual chassis, and the use of an all-steel body. A gasoline engine with an electric motor coupled on the same shaft is mounted on each side of the omnibus and each set drives a rear wheel by means of worm gearing. The weight of the back axle and the differential is thus saved, and these driving units are so mounted that they can be removed in quite a short time. A battery of accumulators completes the essential part of the equipment, the motors acting as generators at times. By adopting the principle of detachable units the necessity of overhauling the motor is much facilitated.—*Lond. Electrician*, July 1.

**Dublin.**—R. S. TRESILIAN.—A paper read before the Tramways and Light Railways Association at Dublin. The author describes the development of tramways in Dublin from the year 1867 to the present time. Brief particulars are given of the existing generating station and the distribution of electrical energy.—*Lond. Electrician*, July 1.

#### Installations, Systems and Appliances.

**Transmission Systems for Agricultural Districts.**—A. VIETZE.—A paper read before the German Association of Electrical Engineers on the growing tendency of German farmers to form combinations and erect their own electric generating and distributing system. It is shown that this has been overdone and that the necessary precaution has not always been observed as to the possibility of making profits. However, under the protection of the Government the situation is now improving. To be economical a transmission system in an agricultural district should be capable of satisfactory extensions, the first expenses in building the plant should be reduced as much as possible, and the methods of financing should be sound. Moreover, a suitable rate of charging is of great importance.—*Elek. Zeit.*, June 30.

**Agricultural Electricity Plants.**—An article giving statistical data on electricity plants in agricultural districts in Bavaria. Nineteen per cent of the inhabitants of farms and of villages below 5000 inhabitants are provided with electric lighting and motor service. The load factor of these agricultural plants is very poor. It is 4.86 per cent for those plants which have a rating below 100 kw and 7.10 per cent for those plants which have a rating from 100 kw to 250 kw. The situation is not very promising.—*Jour. f. Gasbeleucht.*, June 25.

**Vienna.**—P. MARTELL.—An article on the electricity station of the city of Vienna. When the street railways of Vienna were taken over by the city in 1898 it was decided to erect a municipal central station. Three-phase currents were adopted for the transmission of energy to substations where the output is either direct current or low-voltage three-phase currents.

From 1902 to 1907 the rating has been increased from 16,000 kw to 38,350 kw. The increase is partly due to the buying out of some private stations by the city. While formerly steam engines were used, steam turbines have been employed since 1906 for new units. The number of substations was five in 1902 and seven in 1907. The capital invested up to 1907 was \$12,602,200; the net gain in 1907 was \$733,460. The charges per kw-hour are as follows: 3.2 cents for traction, 7 cents for public lighting, 14 cents for private lighting, 9 cents for large consumers and 8 cents for industrial purposes.—*Elek. Anz.*, June 19.

**Water Rheostat.**—J. THILLE.—An illustrated description of a simple water rheostat for laboratory work. The principal feature is the use of running water. The electrodes are of lead. The resistance can be regulated to a certain extent by changing the speed of the water, since the higher the speed the colder the water and the greater its resistance. For most purposes, however, the regulation of the height of the water in the resistance box is also necessary.—*Zeit. f. Electrochemie*, June 15.

#### Wires, Wiring and Conduits.

**Fuses.**—H. W. KEFFORD.—A paper read before the Birmingham Section of the (Brit.) Inst. Elec. Eng., in which the author described some experiments on fuses, and put forward some suggestions for a specification of standard fuses.—*Lond. Elec. Eng'ing*, June 30.

#### Electrophysics and Magnetism.

**Point Discharge.**—O. A. GAGE.—An account of an investigation of the change of the point discharge in air with varying air pressures for pressures greater than atmosphere. The relation between current and impressed potential difference follows the equation  $i \frac{1}{2} = A (V - M)$  for currents varying from 10 to 400 microamperes, where  $A$  is a constant,  $V$  the potential difference impressed and  $M$  the minimum potential. For currents less than 10 microamperes the results are irregular. The pressure of the air has a very great influence upon the true point discharge, due both to an increase in minimum potential and to a decrease in the velocity of the ions. The curves would indicate that the velocities of the positive and the negative ions become more nearly equal at high pressures, due probably to the loading down of the electron by neutral molecules. Some of the results of the author appear to support the view that the velocity of the ions decreases directly as the pressure, while the other results indicate that the velocity varies inversely as the square of the pressure. From the present work there is no means of telling which is the correct relation.—*Phys. Rev.*, June.

**Hertzian Waves.**—H. POINCARÉ.—The first parts of a mathematical paper on the defraction of Hertzian waves with applications to the earth.—*La Lumière Elec.*, June 18 and 25.

**Hysteresis.**—M. G. LLOYD.—A Franklin Institute paper discussing the principles of magnetic hysteresis and methods of measurements.—*Jour. of Franklin Inst.*, July.

#### Electrochemistry and Batteries.

**Aluminum Rectifier.**—A. P. CARMAN AND G. J. BALZER.—A paper read before the American Physical Society on the effect of mechanical pressure on the aluminum rectifier. The paper is illustrated by oscillographic curves and it is shown that the rectifying action decreases with increasing pressure and that the cell practically recovers its action when the pressure is removed. This is easily explained by Schulze's theory that the electrolytic valve action is not due to the oxide film on the surface of the electrode itself, but to a much thinner gas film which exists in the pores of the oxide film and separates the electrolyte from the metal. According to this theory the gas layer will be reduced in thickness by the pressure and hence the resistance of the layer is decreased. It is more difficult to explain another observation of the authors, namely, that an increase of temperature decreased the rectifying action of a special cell, but that cell did not recover its rectifying action when the temperature was lowered again.—*Phys. Rev.*, June.

#### Units, Measurements and Instruments.

**Electrostatic Potential Transformer.**—C. P. HABICHT.—An

illustrated description of an instrument for measuring small quantities of electricity based on a principle of A Einstein. The instrument consists of six "steps" superposed one above the other. Fig. 3 shows a vertical and horizontal section of the second "step" of the instrument. The metallic plates *D* mounted on the columns *B* hold the ball bearings of the axle *C* and also the insulators *J* of the stationary metallic films *E* and *A*. *E* is called the exciter, *A* the receiver (abnehmer). The metallic films *F* are mounted on the axle *C* by means of the insulators *R*. If the axle *C* rotates the films *F* make alternating contact with the spring contacts *H* connected to earth and with the receiver contacts *K* in such a way that all contacts are broken in the moment in which the rotating films *F* are completely surrounded by the stationary films *A* and *E*. If the primary exciter *E*<sub>1</sub> is maintained on a constant positive poten-

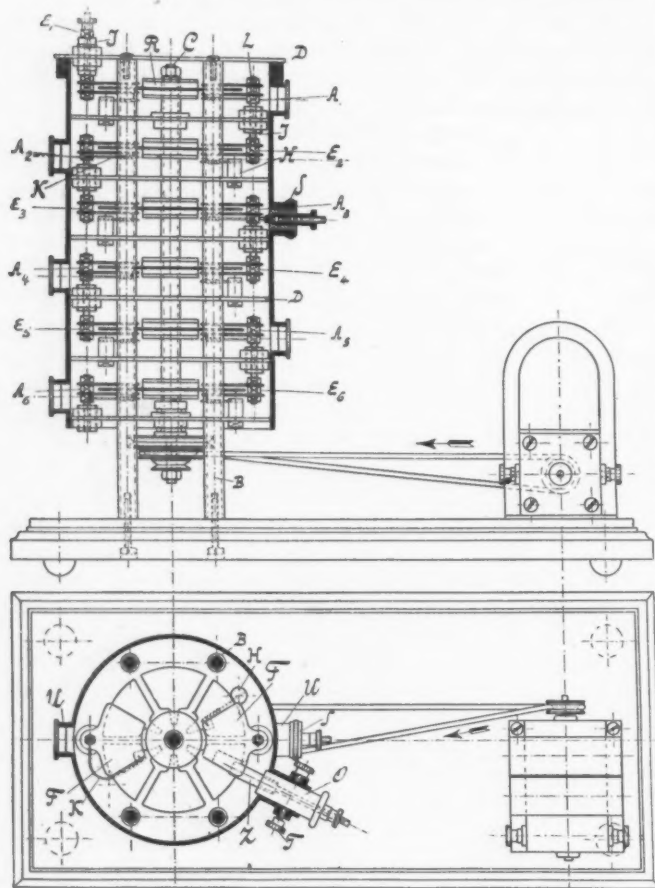


Fig. 3—Diagram of Electrostatic Potential Transformer.

tial  $P_0$ , it forms together with the film  $F_1$ , earthed through  $H_1$ , an air condenser. When  $F_1$  moves away  $H_1$  breaks the earth connection and since  $F_1$  is removed from the exciting yoke, while the quantity of electricity  $F_1$  on it has remained constant, the potential  $F_1$  is increased by a constant amount, the absolute value of which is greater than  $-P_0$ . In the further course of rotation the films  $F$  get into the receiver  $A_1$  and give off charge to  $A_1$  until the potential of the latter has reached a certain value. The absolute value of this potential  $-P_1$ , which becomes stationary after a number of revolutions, is much greater than  $P_0$ . The ratio of  $P_1$  to  $P_0$  is called the "ratio of transformation of step 1." Since the receiver of each step is connected electrically by means of  $L$  to the exciter of the next step the same course of phenomena will be repeated here and the receiver of the  $n$ th step will have after a certain number of revolutions a stationary potential  $P_n = a_1 a_2 \dots a_n P_0$  where the  $a$  represent the ratios of transformation of the different steps.  $A_2 A_4 A_6$  assume charges of the same sign as the primary  $E_1$ , while  $A_1 A_3 A_5$  assume charges of the opposite sign. The metallic plates  $D$  prevent any detrimental effect of one step on another. The whole instrument is protected by means of a metallic case against dust and influence from outside. The connections  $U$

enable one to measure the secondary voltage of the receiver at any step. From this measurement the primary voltage  $P_0$  can be determined. Tests of the instrument have shown that the ratio of transformation  $a$  of any step is constant and independent of the primary voltage  $P_0$ . Variations in the number of revolutions of the driving axle are practically of no influence. The instrument is stated to have considerable advantages over the quadrant electrometer. The proportionality between the primary and secondary voltage is practically perfect. The total ratio of transformation from the primary exciter to  $a$ , is about 8.5,  $a_2$  72.0,  $a_3$  620,  $a_4$  5200,  $a_5$  45,000, and  $a_6$  360,000.—*Phys. Zeit.*, June 15.

*Meters.*—P. MAY.—In watt-hour meters of the Thomson type the commutator and brush collectors usually require electrical cleaning. The positive brush is gradually worn away while small particles attach themselves to the surfaces of the negative brush forming an excrescence. If the construction admits of it it is well from time to time to change both the shunt and the series connections, thus leaving the direction of rotation the same as before while the polarity of the brushes is changed; this will considerably reduce the wear and tear. The author also recommends that the natural period of vibration of the spring collectors be made very short. Moreover, the pressure of the brushes on the commutator should be constant; the pressure should be produced by a steel spring, which takes no part in conveying the current. The e.m.f. between two sections of the commutator ought in no case to exceed two volts; otherwise there is a risk of a short-circuit between the segments. The self-inductance of the armature coils should be kept as low as possible. With a certain type of meter, it has been found possible to have movable brush collectors, which can be displaced more or less by the action of an electromagnet, which carries a current proportional to the whole of the current passing through the meter. Oddly enough, this simple plan has never been applied to the Thomson meter, though any slight increase in cost would be more than counterbalanced by its obvious advantages. An arrangement somewhat as follows might work. Suppose the spring collectors to be arranged on a small lever, pivoted at its center, and carrying a small iron armature, that could be exposed to the action of the field set up by the series coils. The design would cause the collectors to take up a different position with regard to the commutator at full load from what they would have at light load. But this in itself would be of little advantage if deposits were allowed to collect on the negative brush, because at light loads the same errors would arise as before. This could easily be rectified by arranging that as a result of the motion produced by the action of the series field on the suspended armature the brushes should be, as it were, lengthened and shortened. The deposits, which are mostly thrown down at times of full load, would be formed on the brushes at such points as were more or less in contact with the commutator at such times; whereas at light loads, a different position of the brush would be brought into contact with the commutator, which would be smooth and free from deposits. Under these conditions, the readings at light loads ought to remain as accurate as when the meter was new, as the low readings are almost entirely due to the irregular friction of the uneven surfaces, which is much more noticeable when the forces tending to rotate the commutator are small.—*Lond. Electrician*, July 1.

*Zero Shift of Moving-Coil Galvanometer.*—W. P. WHITE.—An abstract of an American Physical Society paper on the relation between the zero shift and the size of wire in a moving-coil galvanometer. The displacement of zero usually produced by the deflection of a moving-coil galvanometer is at present one of the most serious sources of inconvenience or error with that instrument and is not so well understood as are most other features of the design. It increases, of course, with the magnetic impurity of the materials in the coil and is diminished by the use of a radial field. It also depends on the coil constants. For a coil of given performance, the zero shift increases with the size of wire used and with the dead material, and when so expressed is independent of the field strength, shape of coil,

etc., except as the shape affects the amount of dead material. It increases with the excellence of the galvanometer as measured by the smallness of the inertia of the coil—that is, by the delicacy of the coil; for a given coil it is less for shorter periods. If, however, the shorter period is added to a given sensitiveness, which involves a further increase in the galvanometer performance, the shift increases. If the shift is diminished by diminishing the size of wire in the coil this may increase the coil resistance. Hence, an unnecessarily small coil resistance may prove a detriment in moving-coil galvanometers. If finer wire is used, the resistance and moment of inertia of the coil can be kept constant by increasing the width. This change will require a stronger field, hence in such a case the use of a stronger magnet actually contributes toward reducing the error from magnetic impurity in the coil. Of course, a decrease in the size of wire increases the relative weight of the insulation. For ballistic galvanometers a long period is desired, and as far as zero shift is concerned the increase can best be obtained by increasing the moment of inertia of the coil. In that case the zero shift will actually diminish. However, this change reduces the sensitiveness and may sometimes be undesirable.—*Phys. Rev.*, June.

*Alternating-Current Galvanometer.*—W. E. SUMPNER AND W. C. S. PHILLIPS.—An abstract of a (British) Physical Society paper on a new form of vibration galvanometer (Fig. 4). It is like a moving coil galvanometer in almost every respect

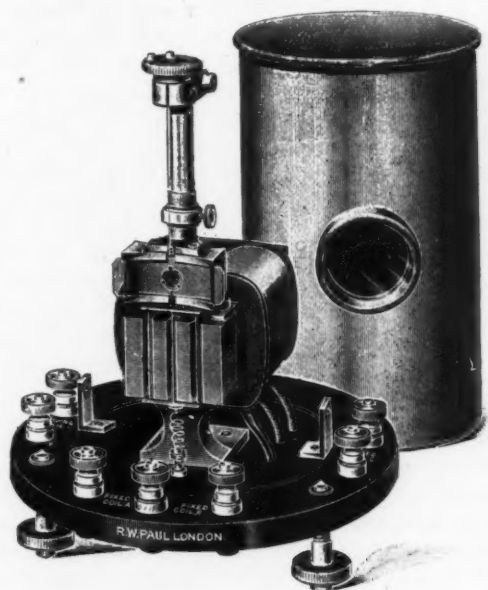


Fig. 4—Reflecting Electro-dynamometer.

except that its field is due to a specially constructed electromagnet excited by an alternating voltage. The voltage  $V$  is applied to a winding of  $m$  turns of the electromagnet and the core flux  $N$  is such that  $V = rA + mN$ , where  $r$  is the resistance of the winding and  $A$  the current traversing it. The coil and electromagnet are so designed that for currents of the frequencies used the value of  $rA$  is negligible in comparison with  $V$ . The rate of change of  $N$  will therefore be at each instant a measure of  $V$ , whatever the permeability or hysteresis of the core. The instrument has a laminated electromagnet formed of stampings of two kinds, a rectangular portion with two straight limbs forming the core of the electromagnet, and a specially shaped stamping between the poles. The moving coil of 50 turns swings in a narrow gap separating the stampings in much the same way as in a permanent-magnet instrument. On the limbs of the magnet are windings of 200, 2000 and 4000 turns. The iron will not be too strongly magnetized if the winding used contains 20 turns per volt on 50-cycle circuits, but the instrument is so sensitive that such excitation will be needed only for exceptional tests. If a voltage  $V$  be applied to one of the field coils of  $m$  turns, and if the same, or another, field winding of  $n$  turns be joined up, through a condenser, of  $K$

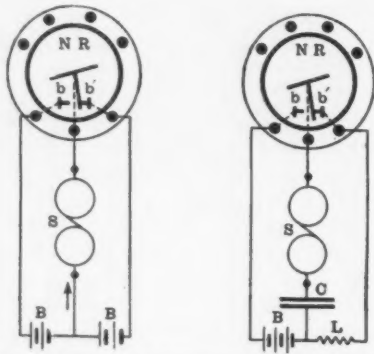
microfarads to the moving coil, the torque acting on this moving coil will be a measure of  $Kn(V/m)^2$ —that is, the deflection is proportional to the square of the voltage. The deflection is independent of the frequency and wave-form if the field winding to which the voltage is applied has a resistance negligible in comparison with its impedance. The instrument may be used with great advantage to compare inductances and capacities by the ordinary bridge methods, the working conditions being: (1) the alternating voltage  $V$  applied to the field coil of the instrument must also produce the current in the bridge conductors, (2) the alternate current in the bridge must be brought into time-phase with the voltage  $V$  by the use of suitable non-inductive resistors, (3) the moving coil must be placed directly across the bridge. The balance can be adjusted with ease to 1 part in 10,000 when the e.m.f. impressed on the coils or condensers is of the order of 1 volt. When a balance of great precision is needed the minute electromotive force  $\epsilon$  induced in the moving coil by the alternating field of the magnet tends to cause a small deflection, thereby disturbing the balance. When the moving-coil circuit is non-inductive, the current due to  $\epsilon$  will be in time-phase with  $\epsilon$  and in time-quadrature with the flux, so that the corresponding deflection will be negligible. But in all cases any effect due to  $\epsilon$  can be accurately eliminated by working to a false zero.—*Lond. Elec. Eng'g*, June 30.

*Neutral Contacts and Switches.*—W. P. WHITE.—An abstract of an American Physical Society paper. The potentiometer is a more recent instrument than the Wheatstone bridge. In many cases apparatus and methods for electrical measurements are now adapted to resistance measurements, where low-resistance contacts are imperative and thermal electromotive forces must take care of themselves. With the newer methods of measuring electrical quantities by means of electromotive force rather than by resistance, the necessity for small contact resistance largely disappears, and it becomes possible to gain a decided advantage by using neutral contacts—that is, contacts which are free from electromotive force. Such a contact is also needed at one point in a potentiometer system. One requirement for a neutral contact is, of course, obvious, namely, that both metals be alike thermoelectrically. Another less familiar requirement is that there shall be no temperature gradient across the contact surface, since in that case the surface layer of the metal, always different from the inside, will form with it a thermo-element. The necessary elimination of temperature gradient is most easily secured by making the contact between two thin strips of metal (from 0.1 mm to 0.3 mm thick) one of them backed by cork or other thermal insulator. The easiest way to get homogeneous metal is also to cut strips from the same sheet, hence practically the essential of a neutral contact is the use of two thin strips of the same sample of metal. When one side of such a combination was placed in direct contact with a plate heated 45 deg. above room temperature, the resulting electromotive force in the contact was too slight to measure—that is, less than 0.1 microvolt. Under ordinary temperature conditions, therefore, such contacts are practically quite neutral. The metal need not be copper, but if it is not, junctions where the switch metal joins copper must enter as pairs oppositely directed in the circuit, and these must be small, close together, and well shielded, so that the temperature of the two junctions shall always be the same. Three forms of neutral contact have been found useful: (1) A sliding contact, much like an ordinary switch, can be arranged with thin strips of metal. (2) Two tongues of metal can be pressed together directly without sliding. Even with copper such an arrangement requires surprisingly little cleaning, and it produces a switch of very simple construction. One rather complicated switchboard was constructed in this way without a single soldered joint. The resistance of such a contact with about 1 kg pressure is about the same as that of the best sliding switches. (3) A tongue of copper pulled through an ordinary wooden clothes pin can be clamped upon a similar strip, thereby forming a remarkably cheap and very effective neutral contact for semi-permanent connections, or even, in

some cases, for use as a switch contact. The last form of contact has decided advantages aside from its neutrality. Compared with a binding post, it is quicker to manipulate and yet much less likely to become loose, is much more adaptable and convenient, and is inferior only in its slightly greater bulk. A cable with such contacts at its ends, ready for instant connection to almost anything, is a very convenient laboratory appliance. By the aid of a couple of strips of celluloid, equally convenient two-pole contacts of this type can also be made.—*Phys. Rev.*, June.

#### Telegraphy, Telephony and Signals.

**Quadruplex Apparatus.**—J. M. FERNANDEZ.—In quadruplex working one of the former difficulties was the breaking of the incoming signals at the non-polarized or "B" side, caused by the operation of the reversing key at the distant end. To overcome this difficulty the use of the relaying sounder was generally adopted. The author has devised a novel simple arrangement which meets the requirements. In Fig. 5, NR is the non-polarized seven-terminal differential relay; S a polarized sounder, neutrally adjusted, so that its lever will remain against either top; B the battery. Normally, the current through  $b'$  and S in the direction of the arrow maintains the lever of the sounder against the upper top; when the relay is operated its lever comes in contact with  $b$ , and a signal is produced by reversing the current through S. This signal will not be disturbed when the distant battery is reversed, though the contact at  $b$  may be broken at that time, because to release the sounder it would be necessary that the relay lever should cross the gap and make contact at  $b'$ , since to affect the sounder it is necessary not only to stop the current, but to reverse its



Figs. 5 and 6—Diagram of Improved Quadruplex Apparatus.

direction. Fig. 6 shows the preceding arrangement modified to obtain the same results without using current from battery B continuously. The polarized sounder is then operated by the successive charges and discharges of the condenser C.—*Lond. Electrician*, July 1.

**Wireless Telephone Transmitter.**—W. DUBILIER.—A description of a new wireless telephone transmitter for utilizing large amounts of energy. The construction is shown in Fig. 7. The two diaphragms  $a$  and  $b$  oppositely disposed are rigidly held on the brass frame so that they can vibrate freely. Upon these are screwed finely polished carbon surfaces  $c$  and  $d$ , which form the sides of the cavity containing the carbon granules shown in  $e$ . These granules form the loose contact between the polished carbon surfaces. To the center of the brass frames are screwed the tubes  $f$  and  $g$  which lead around to one mouth-piece  $h$ . The vibrations are divided up in  $f$  and  $g$ , and act on the diaphragm in opposite directions, thus causing these diaphragms to act simultaneously against and away from each other. Thus, instead of a single diaphragm vibrating and compressing the carbon granules there are two diaphragms operating against each other and on the same granules, producing an amplitude of variation far in excess of that which can be accomplished with a single diaphragm.—*Lond. Electrician*, July 1.

**Telewriter Exchange.**—An account of the opening of the first telewriter exchange in England in which the Ritchie

telautograph, or telewriter, is used. The main principle employed in the telewriter is that of producing two independent motions by the movement of the transmitting pencil, each motion causing a change of current in a circuit. At the receiving end these two varying currents produce independent motions, the resultant of which is a reproduction of the movement of the transmitting pencil. The exchange is at present connected to about 50 subscribers, but provision is made for connecting up an additional 750. The switchboard in the exchange is operated in identically the same manner as an ordinary telephone board, the subscribers telling the operator the number desired by means of the telephone hanging at the side of the instrument. No attention is required at the receiving instrument, so that messages are delivered in the absence of the addressee, and read on the latter's return. The first action of the transmitting instrument is to move the paper at the receiving instrument, so that a clear space is always available.—*Lond. Electrician*, July 1.

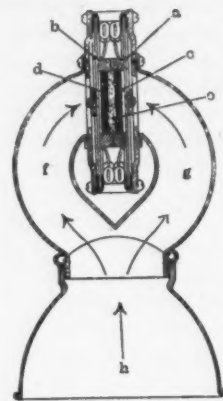


Fig. 7—Cross Section of Wireless Telephone Transmitter.

Electrical Accidents.—The annual report of the electrical inspector of factories in England. He deals at length with the extent to which the regulations are being followed. There were 447 accidents in electrical generating stations and substations. Of these 357 (351 non-fatal and 6 fatal) were of a non-electrical nature, while 90 (86 non-fatal and 4 fatal) were electrical accidents. Accidents to persons cleaning, repairing, or otherwise working upon or near live conductors, form, as usual, the largest class and include four fatal cases. Three of these occurred to unskilled laborers who were employed near exposed conductors at high voltage. The employment of unskilled persons under such circumstances is now forbidden. The fourth fatality occurred to a substation attendant, presumably competent, but who evidently overlooked the danger of the work he was engaged upon, namely, disconnecting a transformer for removal. Two accidents resulting in serious injuries occurred to substation attendants working on switches which had been made dead, but which were in close proximity to live conductors at high voltage not screened off. Electrical accidents in factories, engineering works, and in plants other than electrical generating stations and substations are reported as 249 non-fatal and 8 fatal. The use of poor switches is not infrequently the primary cause for accidents. Another cause which led to quite a number of accidents was the employment of unprotected wires.—*Lond. Electrician*, July 1.

#### Miscellaneous.

**Electrical Accidents.**—The annual report of the electrical inspector of factories in England. He deals at length with the extent to which the regulations are being followed. There were 447 accidents in electrical generating stations and substations. Of these 357 (351 non-fatal and 6 fatal) were of a non-electrical nature, while 90 (86 non-fatal and 4 fatal) were electrical accidents. Accidents to persons cleaning, repairing, or otherwise working upon or near live conductors, form, as usual, the largest class and include four fatal cases. Three of these occurred to unskilled laborers who were employed near exposed conductors at high voltage. The employment of unskilled persons under such circumstances is now forbidden. The fourth fatality occurred to a substation attendant, presumably competent, but who evidently overlooked the danger of the work he was engaged upon, namely, disconnecting a transformer for removal. Two accidents resulting in serious injuries occurred to substation attendants working on switches which had been made dead, but which were in close proximity to live conductors at high voltage not screened off. Electrical accidents in factories, engineering works, and in plants other than electrical generating stations and substations are reported as 249 non-fatal and 8 fatal. The use of poor switches is not infrequently the primary cause for accidents. Another cause which led to quite a number of accidents was the employment of unprotected wires.—*Lond. Electrician*, July 1.

## BOOK REVIEWS

**MECHANICAL DRAWING FOR TRADE SCHOOLS.** By Charles C. Leeds. New York: D. Van Nostrand. Price, \$2.

The course given here consists of 58 lessons, each lesson being made up of a plate and directions for drawing. The lessons cover the use of drawing tools, plane projection, conic sections, construction of curves, sketching, lettering and practice machine and structural drawing.

**THE WIRELESS TELEPHONE.** By H. Gernsback. New York: Modern Electric Publications. 78 pages, 52 ills. Price, 25 cents.

This little book gives brief descriptions of various wireless telephone apparatus and systems. Instructions are given for constructing an induction telephone which may be used for distances up to 50 ft., and of closed-circuit wireless systems which will transmit distances up to three miles. One of the leading systems, and some that are noticed, do not appear to be practicable.

**THE A, B, C OF RAILROAD SIGNALING.** By W. H. Elliott. Chicago: Mackenzie-Klink Publishing Company. 75 pages, illustrated. Price, \$1.

The subject matter of this little book was presented by the author in a lecture before the Harvard School of Business Administration. It is not intended for those already familiar

with signaling systems, but rather for laymen or students of signaling who are about to begin their studies. It offers a sort of bird's-eye view of the subject and as such should be valuable in giving the student perspective and sense of proportion when pursuing his studies into the involved details of the various signal systems.

# New Apparatus and Appliances

## MEASUREMENT OF INSULATION.

A few years ago a direct-reading insulation resistance instrument was invented by Mr. Sidney Evershed, and under the trade name of "The Megger" has been manufactured for several years in England, and recently introduced in this country by James G. Biddle, 1114 Chestnut Street, Philadelphia.

The "Megger" complete and ready for use is illustrated in



Fig. 1—The "Megger."

Fig. 1, where the instrument is shown one-sixth of full size. The insulation resistance to be investigated is connected between the binding posts, one of which is marked "line" and the other "earth," when the crank is turned at fair speed and the amount of insulation resistance in megohms read from the scale. The whole process requires a few seconds, the operation can be conducted by anyone and it is stated that the results

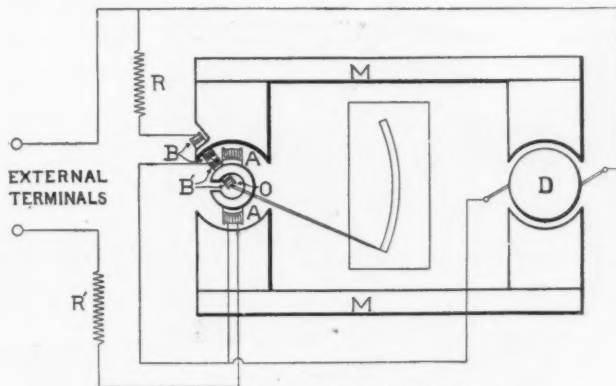


Fig. 2—Diagram of Instrument.

have an accuracy considerably higher than that usually obtainable with other apparatus available for such measurements. The instrument is portable, weighing about 20 lb., is self-contained and is not affected in any way by its surroundings. The scale may be marked up to as many as 2000 megohms.

In Fig. 2 is shown diagrammatically the arrangement of the

interior parts. Figs. 3 and 4 show the interior construction and the moving system, respectively. Referring to Fig. 2, it is seen that permanent magnets *MM* are so arranged that a closed magnetic circuit is formed. In this magnetic circuit at one end a pair of pole pieces are placed between which a dynamo armature revolves. At the other end is another pair of pole pieces, within the field of which the moving system works. The dynamo, driven by the crank placed as shown in Fig. 1 furnishes the e.m.f. by means of which the instrument operates. It usually supplies either 250 volts or 500 volts, which is generated on a drum armature by a winding so arranged that the various coils end on commutators of peculiar disk form, the edges of which at opposite sides are gripped by spring washers which roll with them and maintain excellent contact, acting as brushes (see Fig. 3). By much attention to details of construction, the use of ball bearings, and careful designing, a generator requiring very slight torque for propulsion is secured.

The moving system is made of three coils rigidly connected to each other (see Figs. 2 and 4). Tracing out the connections it will be found that the coil *AA* of the moving system is in series with the apparatus under investigation through the resistance *R*'; this coil exerts a deflecting force in the field where it is placed proportional to the current in it. Coils *B* and *B'* are connected in series. They, with the resistance *R* in series, are put directly across the dynamo terminals, and constitute the controlling coil of the instrument, the amount of their restraining force being a function of the position they take. As shown in Fig. 2, the indicating needle points to zero on the scale; coil *AA* has large current in it and coils *BB'* are exerting a maximum restoring force. Reference to Fig. 4 will show how the moving system is assembled. The current is led in and out of the coils through very slender copper ribbons, which produce no torque; there are no springs, and the needle takes a position determined wholly by the torque of current in a magnetic field.

The proper relation between deflecting and restoring forces is secured through the use of the C-shaped iron piece within

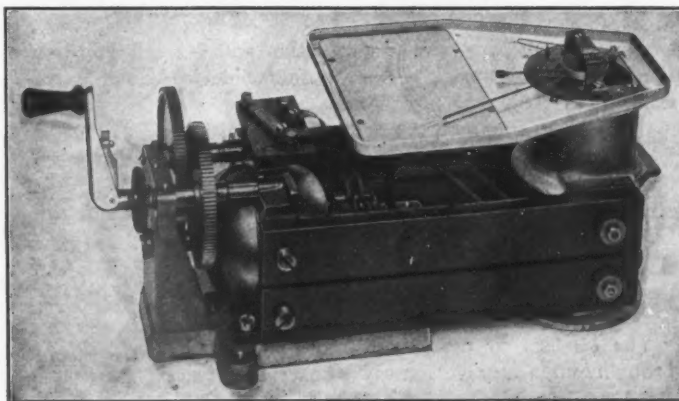


Fig. 3—View of Interior of Instrument.

coil *AA*, which may be seen in Figs. 2 and 4. It is mounted securely in place on the frame which supports the moving system.

The fact that the instrument is of the moving-coil-permanent-magnet type gives it all the good points which belong to this class, while being an ohmmeter it is even more constant in

calibration. For some purposes the variable e.m.f. derived from the dynamo operating at various speeds is very useful, while for others it is bad. Whenever required, a friction clutch is interposed between the last gear and the dynamo armature, so contrived that when operated above slipping speed the e.m.f. is practically constant.

The direct application of the "Megger" to the measurement of insulation resistance are too obvious to need explanation. Because of the fact that the resistance determinations on moderate voltage circuits are made at line voltage or perhaps at higher than line voltage, a sort of combined insulation resistance and break-down investigation can be made.

Among the many indirect applications of insulation resistance measurements one or two may be mentioned. Periodic examination of apparatus for insulation resistance, as is done so readily with the instrument, will reveal any depreciation whether due to moisture—a temporary cause—or to the development of a permanent defect. In this way faults and break-downs can be anticipated and avoided. New apparatus is likely to have insulation resistance so low on account of mois-

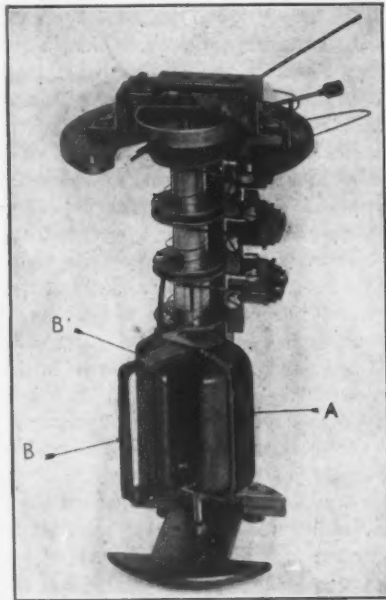


Fig. 4—The Moving System.

ture that it must be dried out before it can be put into service. By the use of the instrument, the time when it is safe to put on normal voltage and set it into operation can be told. There is no guess work about it, and coils are not so baked as to take all the "life" out of the insulation, perhaps scorching them in order to dry them out; and there is no need of applying a breakdown test to strain the insulation and leave it in condition to give way on slight provocation while in regular operation.

In such tests as these mentioned the instrument is as useful for apparatus designed for high-voltage work as for that whose normal e.m.f. is commensurate with that generated in the instrument.

#### STORAGE BATTERY WITH POROUS PORCELAIN PROTECTING PLATES.

The Modern Storage Battery Company, of New York, has brought out a storage battery whose main feature consists in the long life of the plates, due to protecting porous plates. The latter prevent the active material or oxide paste falling off, thus suppressing many troubles in storage battery work. The elements of the battery are composed of perforated lead plates, which are covered with small highly porous porcelain plates or cups having on their internal surface the oxide paste. These little porous plates are undulated and fastened securely to the conducting plates. Inasmuch as the oxide is prevented from falling off, the capacity of each cell remains the same.

The undulations in the porous plates increase the surface of the oxide paste about 15 per cent, it is claimed, thus increasing the discharge rate. Any expansion taking place merely serves

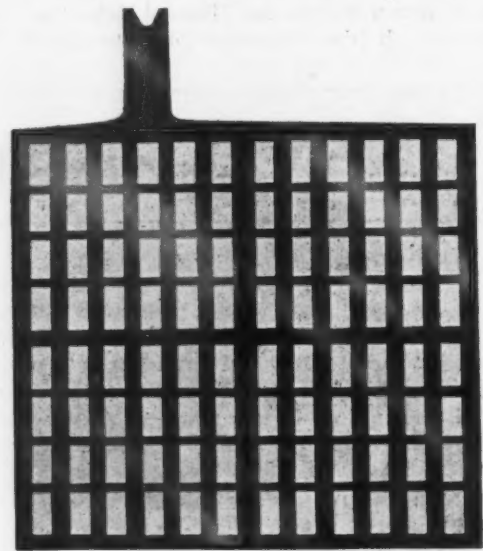


Fig. 1—Lead Conducting Plate.

to make the contact of the oxide paste and the lead plate more intimate and does not increase the internal resistance of the cell. When batteries are overcharged, the boiling of the acid

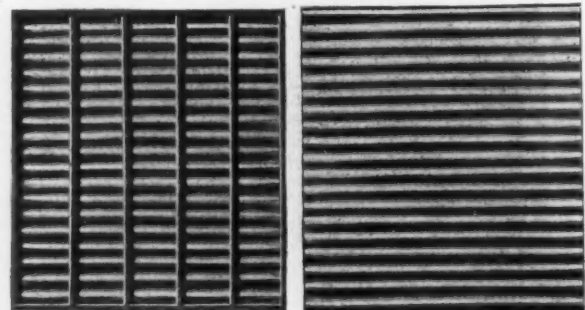


Fig. 2.—Inside and Outside Surfaces of Porous Plates.

does not affect the oxide paste since it is protected by the porcelain covering. The latter also has sufficient capillary attraction to keep the oxide in touch with the acid when the upper portion

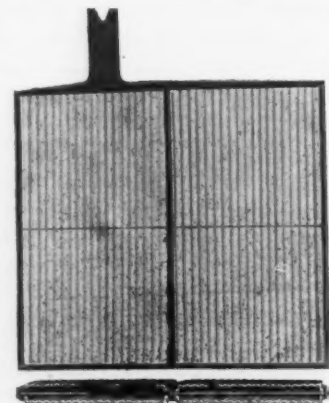


Fig. 3—Completed Plate.

of the plate is not completely submerged in the electrolyte, thus preventing sulphating. Short-circuits caused by oxide falling between plates and bridging them at the bottom is, of course, unknown in the cell described because it is prevented from falling off. The plates are put in special jars where they are firmly held, and the covers themselves are coated with a sealing compound preventing leakage of the electrolyte. Vent caps



are, however, provided to allow free escape of gases. The binding posts, straps and terminals are acid proof, and strong,

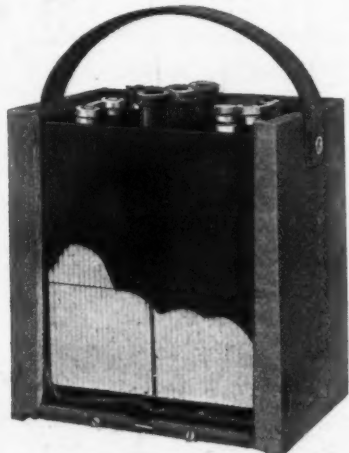


Fig. 4—Battery in Box.

hard-wood boxes with free expansion joints are used to house the entire battery.

**PORTABLE MEASURING INSTRUMENT.**

In order to check the performance of a switchboard voltmeter, for instance, the use of a high-grade portable meter, having an accuracy of 0.5 of 1 per cent, would be far more

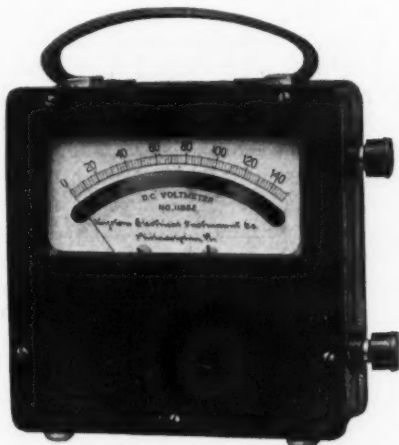


Fig. 1—Portable Measuring Instrument.

reliable than a laboratory standard, although the guaranteed accuracy of the latter might be within 0.1 of 1 per cent. In a similar manner, for a very large number of commercial tests an instrument having an accuracy of 1 per cent would be more suited than one certified accurate to 0.5 of 1 per cent. To fill

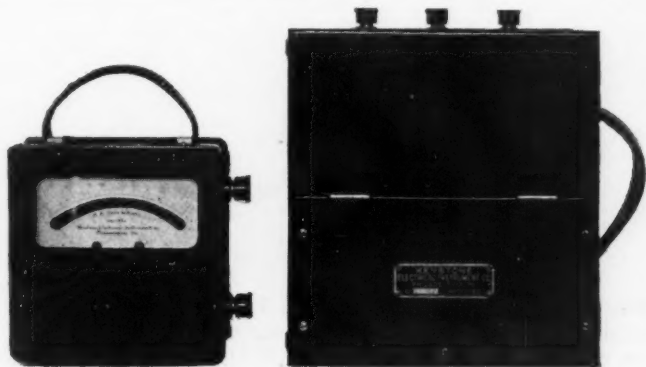


Fig. 2—Portable Measuring Instrument.

this particular demand, the Keystone Electrical Instrument Company, of Philadelphia, has developed a new line of direct-current portable instruments. These, it is claimed, have an

accuracy within 1 per cent and are the smallest of their kind yet produced. Not only is the light weight of these little instruments a factor in their favor, but it is further claimed that their low cost puts them within reach of many who could not afford to purchase more expensive types.

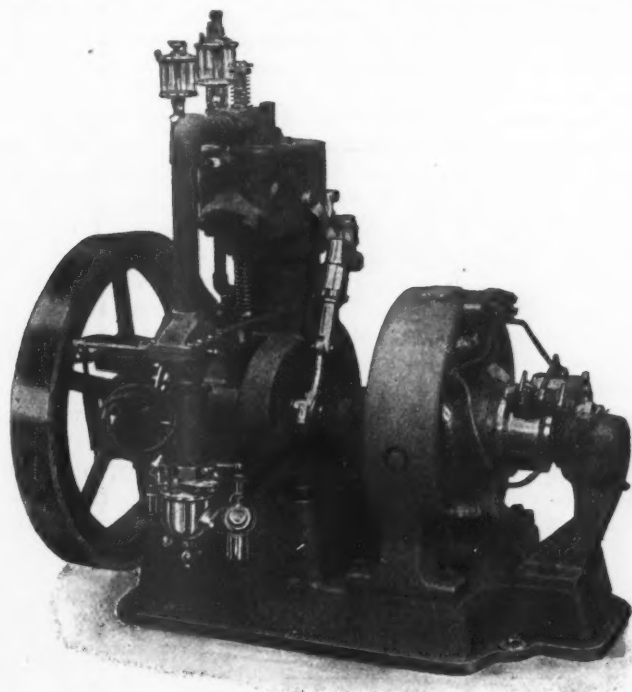
They are supplied in single or multiple ranges, or ammeters and voltmeters can be arranged side by side. Leather carrying cases are also provided when necessary. In common with Keystone ammeters, the shunts are all made interchangeable and the internal resistance of the voltmeters is kept at a high figure which averages 110 ohms per volt.

In designing this new line of testing instruments the makers state three factors were borne in mind; namely, accuracy, size and price. The accuracy was determined at the start as 1 per cent so that it only remained to combine the last two items to the best advantage. Had the size been made any smaller the increased cost of the system to maintain the same degree of accuracy would have been prohibitive. On the other hand, had the cost been needlessly increased it would have defeated one of the chief features of consideration.

The D'Arsonval permanent-magnet system is used, and the scales are drawn in by hand; knife-edge pointers with mirrored scales are also provided to avoid parallax errors. It is claimed that these instruments will stand very much more abuse than precision portables, so that they are particularly well suited for out-door testing where size, weight and ruggedness, coupled with reliability, are the most important items for consideration.

**GENERATING SETS FOR ISOLATED WORK.**

With the increase of the number of country residences desiring electricity for lighting where central station circuits do not reach, many owners have resorted to the installation of small generator sets driven by gasoline engines. The Carlisle & Finch Company, of Cincinnati, Ohio, builds such sets, one of which is illustrated herewith. A 110-volt generator is connected to a single-cylinder gasoline engine, the set being capable

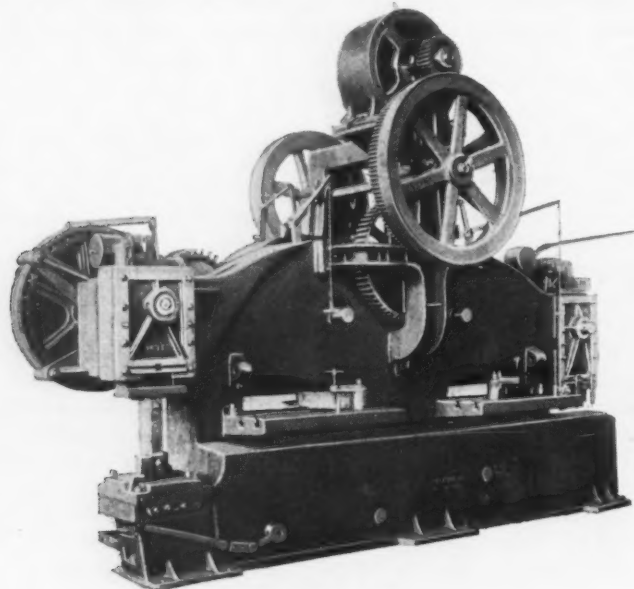


Generating Set for Isolated Work.

of supplying energy to 25 16-cp lamps or a greater number of more efficient lamps like those of the tungsten type. The governor of the engine is said to be sensitive to changes in load, so that lamps may be switched out of circuit without the effect becoming noticeable on the voltage of the circuit. The generating sets have also been used in marine work to generate electricity for search lamps and running lamps and also for interior illumination.

### UNIVERSAL SHEARS FOR CHANNELS, ANGLES AND PLATES.

The accompanying illustration shows a motor-driven universal shear for squaring and mitering channels, angles and plates used in structural steel work. This machine was built especially for the Marine Department of the Maryland Steel Com-



Universal Shears.

pany, Sparrows Point, Maryland, and is applicable in any iron works where steel forms must be cut for construction work.

This machine has a coping attachment at one end, a plate shear at the other and two intermediate 45-deg. angle shears. The coping attachment can also be used as a punch. The plate shear will cut angles up to 6 in. x 6 in. x 1 in. or 8 in. x 8 in. x 3/4 in. and channels up to 15 in. x 3/4 in. Each shear is controlled by its own clutch, and the machine can be operated simultaneously by three groups of men without interfering with one another.

The frames, plungers, pendulums, clutches, and all parts subjected to severe shock are semi-steel castings. The shafts are made from hammered steel containing from 0.4 to 0.5 of 1 per cent carbon. The gears are provided with long hubs which extend through the gear casings. Particular attention has been given to obtaining satisfactory lubrication for all bearings. An especially designed automatic stop motion on each shear throws out the clutch when the shear reaches the highest point of its travel, while a similar automatic stop on the coping device is adjustable, thus allowing the plunger to be stopped at any predetermined point in its downward stroke.

The net weight of this machine is approximately 23 tons and it is designed throughout for long life under most severe service. It is built by the Covington Machine Company, of Covington, Va., and is equipped with a 25-hp, direct-current motor manufactured by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

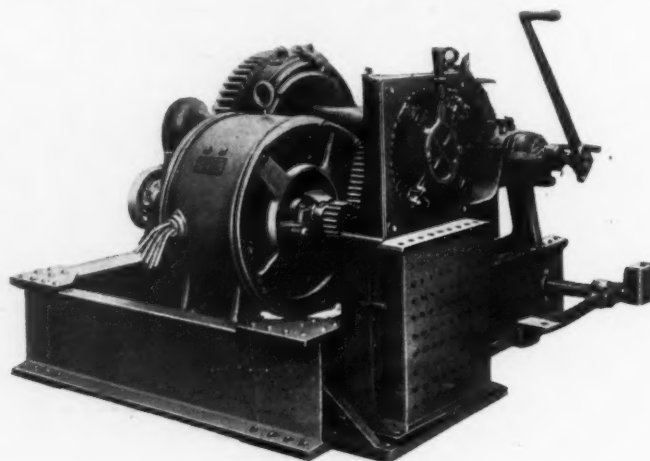
### PORTABLE ELECTRIC HOISTS FOR RENTAL.

The accompanying illustration shows a portable hoisting outfit designed by the Rochester Railway & Light Company and equipped with a Westinghouse motor. The design has proven very effective and has been duplicated for a considerable number of central stations and contractors.

In addition to those already sold, the Rochester Railway & Light Company has retained two completely equipped hoists in stock for rental to contractors, at a nominal charge of \$2 to cover costs of delivering and installing the hoist. For local service direct-current motors are used. Several alternating-

current motors, which can be mounted interchangeably with the direct-current motors, are also held in stock and substituted when the hoists are to be used in outlying districts of the city. No extra charge is made for changing the motors.

The advantage of an electric hoist are numerous and striking. It is compact, durable and self-contained; fuel and water supply need not be considered; the smoke nuisance is eliminated and the depreciation is minimized. When equipped with an electric brake the hoist is absolutely automatic, a single lever giving both power and brake control. In case of interruption to service the electric brake is automatically set, while a mechanical brake actuated by a foot lever affords additional



Portable Electric Hoist.

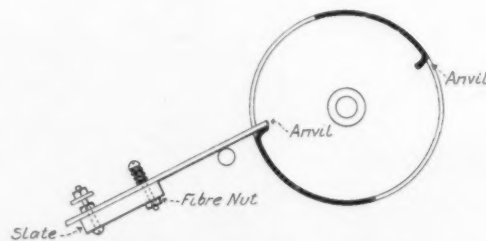
protection. A suitably arranged friction clutch allows the drum to rotate independently of the motor when lowering the load.

The cost of hoist complete, as shown, is \$800, or without the electric brake, \$700. The capacity is 2000 lb. at 200 ft. per minute. Actual average cost of continuous operation at rated capacity on recent construction is 60 cents per day.

The motor-equipment for direct-current consists of a 15-hp, 1000-r.p.m. Westinghouse motor back-gearred to give a countershaft speed of approximately 230 r.p.m., a controller and resistance are included. For alternating current the equipment consists of a 15-hp, 1120-r.p.m. Westinghouse motor, back-gearred to give a countershaft speed of approximately 230 r.p.m. An intermittent service reversing controller is included.

### NON-ARCING ANVIL FOR FLASHER.

The accompanying cut shows a "Reco" flasher of the brush-switch type, supplied with a non-arcing anvil, which prevents the burning away of the cylindrical contact. The angle at which the brushes are set to the drum enables the use of the



Non-Arcing Anvil for Flasher.

non-vibrating insulated bar for the brushes to rest on. The brushes have full contact from the instant they come into contact with the drum until they break. The minimum of air-gap is 1/2 in. The illustration also shows the manner in which 1-amp brushes are attached to the slate. To renew the brushes it is only necessary to remove one screw. This type of flasher is made by Reynolds Electric Flasher Manufacturing Company, Chicago, Ill.

# Industrial and Commercial News

## THE WEEK IN TRADE.

**C**ONSERVATISM still characterizes most lines of trade and industry. The regular summer stagnation prevails in almost every section of the country. As a whole, however, during the past week business was probably as good, in a retail way, as it was in mid-July, 1909. As yet very few orders are being taken for fall delivery by wholesalers and jobbers. The first delegations of buyers are already in the central markets, but as a rule there appears to be a disposition to move slowly and purchase conservatively. Throughout the entire country there seems to be a feeling of uncertainty and a disposition to wait for a more settled condition of the money and securities market. In the industrial field there is still an abundance of evidence of curtailment. This is not only true in the textile industry, which has been curtailing for months, but it can be observed in the iron and steel industry. In the latter there is also a distinct movement in the direction of lower prices. The steel corporation is quoting some of its wire products at substantial concessions, and in almost every line some price reductions have been made. Another factor in the present condition of uncertainty is the threat of labor troubles in Pennsylvania and other industrial centers. Such disturbances, if at all widespread, would have an extremely disheartening effect upon all branches of trade. It is only when workmen are fully employed that retail trade can prosper. The crop situation, while as yet unfavorable in regard to wheat, is, taken as a whole, quite satisfactory. Collections can only be classed as fair, and in many sections they are distinctly slow. Business failures for the week ended July 14, as reported by *Bradstreet's*, were 202, as compared with 182, the previous week, 206 in 1909, 258 in 1908, 177 in 1907, and 188 in 1906.

## THE COPPER MARKET.

**C**OPPER recorded some new low levels during the past week. Although the volume of business was fairly large, prices were almost at the bottom of the year. The condition of the copper market is particularly unsatisfactory to the selling side. Consumers and other purchasers understand that production is going on at a rate beyond that of any other previous year. In addition, imports are coming forward in such volume that they add largely to the supply of copper in hand. The only way to meet this situation would be for consumers to vastly increase their purchases, and this has not been done. Prices for copper have not declined in the proper ratio of the supply and demand figures. This is mainly because the Amalgamated Copper Company has such a tremendous investment, and controls such a large portion of the output of copper, that it will not permit prices to be put on a basis below that

Standard Copper.	Bid.	Asked.	Settling price.
Spot .....	11.50	12.00	.....
July .....	11.50	11.90	11.70
August .....	11.50	11.95	11.72½
September .....	11.50	11.95	11.72½
October .....	11.50	11.95	11.72½

The London market June 18 was as follows:

	Noon.	Close.
	£ s d	£ s d
Standard, copper, spot.....	53 15 0	53 12 6
Standard copper, futures.....	54 7 6	54 5 0

Extreme fluctuations for this year:

	Highest.	Lowest.
	13.50c	11.70c
Standard .....	13.50c	11.70c
London, spot.....	£62 0 0	£52 15 0
London, futures.....	65 18 9	53 7 6
London, best selected.....	65 10 0	57 15 0

which would mean a profit to the Amalgamated Company. The statistical position of copper is adverse to the market. Every one who knows anything about it understands that more copper is being produced every day and every week than is being consumed. The fact that this is not all thrown upon the market at once, and that the market is not broken thereby, shows that the financial backing of the Amalgamated Copper Company is all powerful. In the meantime very many outside firms and producers are talking about curtailment. These people recognize the fact that unless there is some curtailment in the production of copper the market will be overstocked for all time to come. Imports continue to be large, and many countries are sending their product to America which never before considered this

a good market. Exports for the month, including July 18, were 12,697 tons. The daily call on the metal exchange July 18 quoted standard copper as per accompanying table.

## INDUSTRIAL AND COMMERCIAL NOTES.

**Gould Storage Batteries for Car Lighting.**—The Pennsylvania Railroad has recently made a contract with the Gould Storage Battery Company for 431 sets of storage batteries of 32 cells each, to be used in its car lighting service. It is said that this is the largest single order for storage batteries ever placed by a railroad company. The batteries are the standard 300 ampere-hour twin-cell car-lighting type operated on the straight storage system, except a few which are to be used on axle generators. The company has also recently sold to the Japanese government a storage-battery equipment for the new submarine which Japan has recently constructed. This is the first submarine that country has ever built. The General Electric Company furnished the electric equipment. W. S. Gould, president of the Gould company, says that the business of his concern has been better so far this year than ever before in its history. He says that there has been quite an extensive revival in the demand for storage batteries, and at the present time his company has enough orders on hand to keep the plant fully employed for the next seven or eight months.

**Worcester Consolidated Street Railway to Build Power Plant.**—Plans are being set in motion by the Worcester (Mass.) Consolidated Street Railway Company for the enlargement of its power generating capacity. A turbine installation of about 3000 kw rating will be made on the company's property in Millbury. About 40 acres of land are owned by the company at Millbury, the site of the new station having for many years been used by a small direct-current generating plant supplying power to the Blackstone Valley lines. The plans now contemplate the transmission of alternating current from the Millbury station to a substation to be located on Park Street, Worcester, within a few hundred feet of the center of electrical distribution for the city. The cost of the work is estimated at about \$300,000. The present power supply of the Worcester city lines is furnished by a steam plant located about 2 miles south of the center of the city, the distribution being by 575-volt direct-current.

**Umbrella Type Alternators.—Domestic Electrical Appliances.**—C. M. Shaw, city electrical engineer for the Corporation of Worcester, England, and of the Municipal Electricity Works, will pay a visit to this country in August and September, and asks us to say that he invites manufacturers to forward him particulars of up-to-date turbine plants and umbrella-type alternators to work on a head varying from 10 to 13 ft., and with a capacity of from 150 to 600 hp, together with names of power houses where the same can be viewed between New York westward to Chicago, and thence eastward through Canada to Quebec. Mr. Shaw wishes also to receive descriptive matter from makers of the latest domestic electrical appliances, not including lighting.

**W. H. Schott Company.**—The stock in the new W. H. Schott Company has been increased from \$2,500 to \$300,000. The company has a suite of offices in the Steger Building, 39 Jackson Boulevard, Chicago, and is organized to do a general engineering and contracting business, although, no doubt, as in other days, Mr. Schott and his associates will devote themselves largely to the designing and erection of central-station heating plants. Associated with Mr. Schott, who is president of the company, are M. O. Payne, vice-president and director; J. C. Harding, chief engineer and director, and A. L. Greist, chief draftsman.

**Electrose Manufacturing Company.**—The Electrose Manufacturing Company, of Brooklyn, N. Y., has been incorporated under the laws of the State of New York with a capital stock of \$100,000, the incorporators being Louis Steinberger, of Brooklyn, John H. Poggenburg, of New York City, and Felix Steinberger, of Brooklyn. The stockholders, directors and management are the same as those formerly identified with the Electrose Manufacturing Company, incorporated under the laws of Illinois.

**Mexican Electric Properties.**—The formal transfer of the holdings of the Electric & Irrigation Company, of Hidalgo, to the Mexican Light & Power Company, the Canadian concern, which has already expended nearly \$50,000,000 gold in electrical development in this part of Mexico, marks the beginning of another epoch in the progress and up-building of the great Pachuca mining camp in which many Americans are interested. The Electric & Irrigation Company, of Hidalgo, was one of the pioneer hydroelectric concerns in Mexico. It paved the way for the awakening of the Pachuca camp from the many years of lethargy which hovered over it. It was in 1897 that this company was organized with a capital of one million dollars for the purpose of utilizing the waters derived from the drainage of the great valley of Mexico in which the capital of the republic is situated. With the completion of this stupendous drainage project it was seen that an enormous flow of water came through the tunnel and canal. The company constructed a dam across the Salado River which carried the drainage waters. This dam was situated at Flamenso, from which point a canal was constructed to Juando, 16 miles. The first hydroelectric plant was erected at Juando, and a transmission line built to Pachuca, 30 miles. The company purchased the old electric light and power plant of Rafael M. Arrozarena, in that city. While it was the primary purpose of the company to provide the city of Pachuca with lights and power, it was upon the demand for an extension of the service to the larger of the mines of the district that the original 4,000-horsepower plant was found insufficient and a second hydroelectric plant was installed. It was of 6,000-horsepower capacity.

**Charles L. Kiewert Company.**—The principal office of the Charles L. Kiewert Company has been transferred from Milwaukee to 39 Cortlandt Street, New York. This change makes practically no change in the business methods of the company, but simply means that the New York office is hereafter to be considered as headquarters. W. F. Hessel, the New York manager, declares that business is better than it has ever been before. The demand for flaming arc lamps, he says, is continually growing and many cities are beginning to consider their use in the lighting of business centers. The "Alba" vertical carbon lamp he says is especially in demand, and quite a number of important installations have been recently made. The Kiewert Company has recently equipped an immense roller coaster in Chicago with 80 lamps of this type. Another product for which his company has found ready sale, according to Mr. Hessel, is the "Bio" carbon for moving picture machines. This carbon was brought out after a year of experimentation and, it is claimed, has nearer the effect of a calcium light than any carbon yet produced. Samples of this carbon were spread around among the moving picture people in March, and, according to Mr. Hessel, the popularity of the light was instantaneous. Orders followed in almost every case where the sample was tested.

**Individual Drive in Tractor Plant.**—The new tractor plant of the International Harvester Company, Marshall Boulevard, Chicago, which is now under construction, will contain about 600 kw total connected rating of motors, most of which will be in individual units for the drive of the various machine tools. The new factory building is of concrete and steel, and is unusually handsome in exterior design. About \$600,000 is being invested in the building and equipment, which will be completed by September. Energy will be supplied from the company's private power plant. The flue gases from a reverberatory furnace used for the manufacture of malleable iron will be led through boilers, imparting their heat content which would be otherwise wasted, to produce steam at 120-lb. pressure, and superheating it 100 degrees. This steam will be utilized by turbines (1500 kw in total rating) driving generators which will supply electrical energy for the tractor plant and other purposes about the works. Experiments with the recovery of heat from furnace gases have been carried on by the International Harvester Company for several years.

**Aluminum.**—According to a representative of the Aluminum Company of America the demand for this metal has been fairly good during the first six months of 1910. "In no special directions," said this representative, "has there been any great boom in aluminum, but there has been a good, steady business. The principal demand and the principal increase in our business comes from the automobile manufacturers and the makers of automobile bodies. This business has been quite heavy. There have been no big contracts for wire for transmission purposes since the large Canadian order

last November, which the *Electrical World* published at the time. We are selling some wire all the time, and aluminum for transmission seems to be growing in popularity, especially in the South, where the Southern Power Company has used it to considerable extent. The price of the metal remains about the same, the crude metal selling from 20 to 23 cents per pound. The reduction in duty rate does not affect price."

**Pennsylvania Railroad Pittsburgh Subway.**—It is said at Pittsburgh that the Pennsylvania Railroad Company is inquiring into a subway arrangement in that city. The question of a franchise to operate the proposed route from the East End district to the downtown section of the city is being considered. It is proposed also to construct an extension under the Allegheny River to the Fort Wayne station on the north side. All of these lines, if eventually constructed, will be operated by electricity. It is believed that it would be an easy matter to drill a tunnel through the hills to East Liberty and to install a central downtown terminal. From this terminal one tube might reach to the north side coming to the surface in the Fort Wayne yards, and another might reach to the "Panhandle" tracks on the other side of the Monongahela River. All of these plans are entirely tentative, but any plans for a subway terminal in Pittsburgh would mean the electric operation of all of the tunnel trains.

**American Conduit Company.**—W. W. Grant, representative of the American Conduit Company in New York, reports that the demand for conduits during the first half of 1910 was extremely heavy. He says that the business of his company during this period was more than five times as large as during the same period last year. Good shipments have been made to all parts of the country, and there have been quite a number of large orders from abroad. The company has sold to the Los Angeles Gas & Electric Corporation 500,000 ft.; to the Southern California Edison Company, of Los Angeles, 400,000 ft., and to Mexico, 50,000 ft. "There seems to be a movement all over the country," said Mr. Grant, "in the direction of putting the wires underground, in all cities and towns of any size. In most cases this is being gradually done, and our sales are therefore continuous and promise to extend over a period of years. It will not be a great while before there will be no overhead wires in thickly settled parts of cities."

**Pennsylvania Water and Power Company.**—President J. E. Aldred, of the Pennsylvania Water and Power Company, which has a transmission plant at Orangeville, Md., is reported to be negotiating with the United Railway and Electric Company, of Baltimore, for the supply of electric power to the latter. The Pennsylvania company owns some interest in the Consolidated Gas, Electric Light and Power Company, of Baltimore, but is far from being in control. An officer of the Pennsylvania company said that a contract had been negotiated but not signed between the Consolidated and the hydroelectric company, whereby the latter would furnish energy to the former. He would not deny that negotiations were pending with the railway company, but did deny that his company was attempting to buy control of the railway.

**Activity in Telephone Manufacturing.**—It is reported that the great Hawthorn works of the Western Electric Company, in the western suburbs of Chicago, now devoted entirely to telephone manufacturing, are overcrowded with work. Extensions are under way and the company is endeavoring to secure help in some branches, such as tool-making. It is believed that the present year's business will approximate that of 1906, which was a banner year in the telephone industry. In the cable factory, it is said, that the company is insulating 125,000,000 feet of telephone conductor a month. The entire plant is well employed, but more operatives could be used in all departments. All of the departments of the Western Electric Company are well employed.

**Electrical Construction.**—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions of present plants at Morgantown, W. Va.; Buffalo, N. Y.; Elmira, N. Y.; Welch, W. Va.; Leslie, Ark.; Honea Path, S. C.; Waupun, Wis.; Carthage, Mo.; Ephratah, N. Y.; Waterloo, Ia.; Omaha, Neb.; Akron, Ohio; St. Louis, Mo.; Bismarck, N. D.; Martinsville, Ind.; London, Ont., Can.; Miles City, Mont.; Milliken, Col.; Lincoln, Cal.; Mellen, Wis., and Fultonville, N. Y.

**General Electric Company Motors.**—The Hudson & Manhattan Railroad Company has placed its contract for motors to equip the cars which will go into service on the Newark extension, with the General Electric Company. The order consists of 80 double equipments 200-hp motors, type "M" control.



**Wilmington & Philadelphia Traction Company.**—The organization plan of the Wilmington & Philadelphia Traction Company, which was recently formed with a total capitalization of \$6,500,000 to be a holding company for all of the Interstate Railways Company properties south of Philadelphia, is now made public. The formation of the new company effects the merger of these properties with the Wilmington Light & Power Company. The stock of the new company is divided into \$1,500,000 preferred and \$5,000,000 common, of which there is outstanding \$500,000 of each. The company has no bonded indebtedness, but it guarantees payment of all interest charges of the companies included in the merger, and at the same time pays a yearly rental to these companies on a graduated basis. The companies included are the Wilmington City Railway Company, the Wilmington City Electric Company, the Chester Traction Company, the Wilmington & Chester Traction Company, the Delaware County & Philadelphia Electric Railway Company of Clifton Heights, Pa., and the Wilmington Light, Power & Telephone Company. The company does all the electric lighting and power business of the city of Wilmington and has about 92 miles of street railways extending from Wilmington to the suburbs of Philadelphia. It is said that the new merger was formed in order to end a disastrous rate war between competing companies, which had existed for a long time. Nearly all of the properties concerned were acquired by leases extending 999 years. It is understood that O. T. Crosby, who is associated with J. G. White & Company, will be president of the new company.

**Associated Gas & Electric Company.**—The Associated Gas & Electric Company, which was organized last year by W. S. Barstow & Company, and which controls a number of gas and electric properties in small cities, has purchased through its subsidiary, the Greenville, Ohio, Gaslight Company, all of the mains and plant of the Indiana Lighting Company in Greenville. The natural gas in that section having failed, the Indiana Lighting Company had no further use for this property. The Greenville company is building a new plant and will extend its service in a number of directions. President Barstow of the Associated company says that all of the subsidiary companies are showing satisfactory increases in net earnings, and that there is every reason to expect the company to continue to earn more than the 6 per cent dividend now being paid on the preferred stock.

**Electric Railway Bonds in Paris.**—D. C. Nevin, president of the St. Louis-Kansas City Electric Railway Company, announces that he is negotiating the sale of a \$15,000,000 bond issue in Paris. It is said also that work on the road will be commenced within a short time, and that 75 per cent of the route has already been established. It is proposed to run hourly trains between these two cities with stops at all stations, and also to operate four express trains a day which will stop

only at the larger points. The road will handle mail, express and freight. The company has 10,000 acres of coal land in Boone, Howard and Lafayette counties, Missouri. The power plant will be built near these coal fields.

**Interborough-Metropolitan Bond Plans.**—The financial heads of the Interborough-Metropolitan Company are working on a plan for the retirement of a portion of the outstanding \$67,825,000 4½ per cent collateral trust bonds. This action is made desirable because by the recent issue of \$4,000,000 of 6 per cent notes the company has increased its fixed charges to almost \$100,000 more than its gross income. Of course, the company could easily meet this deficiency by increasing the dividend rate of the Interborough Rapid Transit Company, but it is thought that such a course would cause adverse criticism.

**Edison General Electric Company.**—At a meeting of the stockholders of the Edison General Electric Company at Schenectady, last week, the company was formally dissolved. The fact that this action would be taken was referred to in our issue of June 23. A certificate of dissolution will be filed with the Secretary of State. The company, which is entirely the property of the General Electric Company, has existed in name only for many years and was kept alive only on account of certain patent rights which have now expired.

**DIVIDENDS.**

American District Telegraph Company, of New Jersey, quarterly, 1 per cent, payable July 28.

American Gas & Electric Company, quarterly preferred, 1½ per cent, payable Aug. 1.

Binghamton (N. Y.) Light, Heat & Power Company, quarterly, preferred, 1½ per cent; common, ¾ per cent, both payable July 15.

Commonwealth Edison Company, quarterly, 1½ per cent, payable Aug. 1.

Electric Bond & Share Company, preferred, quarterly, 1¼ per cent, payable Aug. 1; common, quarterly, 2 per cent, payable July 15.

Grand Rapids Railway Company, preferred, quarterly, 1¼ per cent, payable Aug. 1.

Havana Electric Railway Company, quarterly, preferred, 1½ per cent; common, 1½ per cent, both payable Aug. 13.

International Pneumatic Tube Company, preferred, semi-annual, 3 per cent, payable July 20.

Michigan State Telephone Company, preferred, quarterly, 1¼ per cent, payable Nov. 1; common, 1¼ per cent, payable Sept. 1.

Milwaukee Electric Railway & Light Company, preferred, quarterly, 1½ per cent, payable Aug. 1.

Public Service Investment Company, Boston, preferred, quarterly, 1½ per cent; common, semiannual, 1¼ per cent, both payable Aug. 1.

**REPORTS OF EARNINGS.**

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Telephone & Telegraph Company:					
Six months ended June 30, 1910.....	\$17,595,895	\$1,694,485	\$15,901,410	\$2,586,355	\$13,315,353
Six months ended June 30, 1909.....	15,212,832	1,226,953	13,985,879	3,892,623	10,093,255
Associated Bell Operating Companies:					
May, 1910.....	13,504,386	5,073,407	3,932,327	1,014,186	2,918,141
May, 1909.....	12,179,283	4,547,878	3,886,893	829,080	3,057,813
British Columbia Electric Railway Company, Vancouver:					
May, 1910.....	256,806	157,417	99,389	.....	.....
May, 1909.....	197,802	116,408	81,394	.....	.....
Blackstone Valley Gas & Electric Company:					
May, 1910.....	75,458	37,340	38,118	29,161	8,957
May, 1909.....	69,972	37,722	32,250	28,791	3,459
Columbus (Ga.) Electric Company:					
May, 1910.....	37,227	15,550	21,720	17,615	4,105
May, 1909.....	30,820	15,875	14,945	12,886	2,059
Dallas (Tex.) Electric Corporation:					
May, 1910.....	115,592	81,398	34,194	26,622	7,572
May, 1909.....	103,525	66,182	37,342	28,839	8,503
Denver Gas & Electric Company:					
June, 1910.....	.....	.....	76,367	37,382	38,985
June, 1909.....	.....	.....	72,835	34,840	37,995
Edison Electric Illuminating Company, Boston:					
June, 1910.....	354,840	159,797	195,043	.....	.....
June, 1909.....	293,885	144,469	149,416	.....	.....
Edison Electric Illuminating Company of Brockton:					
May, 1910.....	22,978	13,050	9,928	3,787	6,141
May, 1909.....	19,515	10,906	8,609	3,192	5,417
El Paso (Tex.) Electric Company:					
May, 1910.....	51,148	30,918	20,230	8,218	12,012
May, 1909.....	47,509	28,681	18,828	7,900	10,928
Galveston-Houston Electric Company:					
May, 1910.....	103,822	66,317	37,505	23,548	13,957
May, 1909.....	103,603	58,731	44,872	21,420	23,452
Jacksonville (Fla.) Electric Company:					
May, 1910.....	46,720	25,530	21,190	9,307	11,885
May, 1909.....	39,656	23,181	16,475	9,281	7,194
Minneapolis General Electric Company:					
May, 1910.....	93,626	40,626	53,000	31,157	21,843
May, 1909.....	84,673	37,340	47,333	29,670	17,663
Pacific Light & Power Corporation, Los Angeles:					
Four months ended April 30, 1910.....	695,852	386,958	308,894	172,921	135,973
Four months ended April 30, 1909.....	597,751	350,121	247,630	168,013	79,617

# General News

## Construction News.

Arranged alphabetically by States.

**BIRMINGHAM, ALA.**—F. A. Burr, Thomas O. Smith, Frank Nelson, S. E. Thompson and others are reported to be interested in a project to construct an independent electric railway from Birmingham to Ensley, via Owenton and Shadyside.

**HARTSELLS, ALA.**—At an election to be held Aug. 8 the proposition to issue \$28,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant and water works system, will be submitted to a vote. Plans are being prepared by Xavier A. Kramer, of Magnolia, Miss.; J. H. Corsable is Mayor.

**MONTGOMERY, ALA.**—The Montgomery Light & Water Company has been awarded a contract by the city to furnish electricity for operating the pumping station of the municipal water works for a term of 10 years, with the privilege of renewal.

**FLORENCE, ARIZ.**—T. J. Prescott, of Phoenix, Ariz., has been in this city recently making investigations with a view of installing a combined electric light, power, water and ice plant in Florence.

**PHENIX, ARIZ.**—Surveys are now being made for an electric railway from Mesa City to the Chandler ranch, a distance of 14 miles. The proposed railway will be built next fall and will connect with a railway from Mesa to Phoenix, work on which will start in the fall. Another extension from Phoenix to Glendale is also contemplated next winter, which will give about 40 miles of additional car service.

**WALKER, ARIZ.**—The purchase of an electric hoist and crushing plant is reported to be under consideration by Griffin & Company, of Walker, Ariz.

**LESLIE, ARK.**—Plans are being prepared by the Leslie Light, Water & Power Company for the construction of an electric light plant and water works system, to cost about \$20,000. J. W. Vaughn, of Leslie, and James F. Kiser, of Little Rock, Ark., who were recently granted a franchise by the City Council are understood to be interested in the project.

**CHICO, CAL.**—Plans are being considered by the Northern Electric Company for the construction of a branch line from Yuba City to Colusa, work on which will soon be started. It is expected that the railway will eventually be extended to Woodland, Cal.

**DUNSMUIR, CAL.**—The Siskiyou Electric Power & Light Company has acquired all the electrical holdings of the Mossbrae Falls Water & Power Company, which gives the first-named company the entire field for electrical service. The Mossbrae power plant will be abandoned and the distributing system taken down.

**EUREKA, CAL.**—Plans are being considered by the merchants and the officials of the Humboldt Gas & Electric Company for the installation of an ornamental street lighting system in the business section of this city.

**GARDEN GROVE, CAL.**—The Town of Garden Grove, (unincorporated) has petitioned the Board of County Supervisors to call a special election in the town to vote on the proposition of establishing and maintaining a street lighting system.

**GEORGETOWN, CAL.**—The power house of the Horseshoe Bar Electric Company, at Horseshoe Bend, located on the middle fork of the American River, five miles east of Georgetown, has been put into operation. The company will furnish electricity for lamps and motors to towns and mines in this county, which heretofore have not had electrical service. Preparations are being made by S. W. Collins and other citizens of Georgetown to erect a transmission line from the power house to Georgetown for the purpose of supplying electricity to residents in this town. It is expected that the line will be extended to Greenwood and the Garden Valley district, where many valuable mining properties are awaiting power for development. The Horseshoe Bar Electric Company is furnishing electricity to the Cash Rock Gold Mining Company for operating its gold dredge, located about five miles south of the power house.

**LINCOLN, CAL.**—The Pacific Gas & Electric Company, which owns and operates the local electric light system, is contemplating extensive improvements to the local plant. The system, it is said, will be practically rebuilt and a day service installed.

**OAKLAND, CAL.**—The San Francisco, Oakland & San José Railroad Company has placed a contract with the Central Railway Signal Company, of Rochester, N. Y., for a complete electric locking signal system for its three mile pier and its main lines. Signals are to be placed every 450 ft. on the pier.

**OAKLAND, CAL.**—Application has been made to the superior court by the Richmond Light & Power Company for dissolution. The concern was incorporated in 1902 and Oakland was the principal place of business. The directors are: Evans Williams, J. S. Lanison, A. L. and Harry Chickering and Winfield Dorn.

**OAKLAND, CAL.**—The Southern Pacific Railroad Company has ap-

plied to the City Council for a franchise to extend its track skirting the bay shore in North Oakland to the right of way obtained in Berkeley. The franchise if granted will supply the connecting link to complete the loop system of electric service which the company proposes to establish in Berkeley.

**PLACERVILLE, CAL.**—Notice has been filed with the county recorder by H. H. Baker of an appropriation of 50,000 cu. in. of water of the Rubicon River. The water will be diverted at a point on the river a short distance from what is known as the Grasshopper Bar. The water will be utilized to generate electricity for the operation of electric railways.

**POMONA, CAL.**—Property owners on East Sixth and Eighth streets have petitioned the City Trustees for street lamps, which, it is said, will probably be installed.

**SAN FRANCISCO, CAL.**—The Standard American Dredging Company, of San Francisco, Cal., has recently placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for a 500-kw, 2300-volt, three-phase, 60-cycle, 3600 r.p.m. generator to be installed on one of its dredges to furnish electricity to drive a 500-hp. motor direct connected to the dredge pump. The alternator will receive excitation from a 15-kw, Allis-Chalmers generator direct connected to an engine made by the American Blower Company.

**SAN RAFAEL, CAL.** The Town Trustees have instructed L. Richardson, county surveyor, to visit San Francisco and secure data on its street railway system for the purpose of making a report at the next meeting in connection with the application of W. L. Courtright for a franchise to operate an electric railway within the town limits. The railway is being promoted by capitalists and business men of Novato, San Rafael, San Anselmo, Kentfield, Larkspur, Ross and Corte Madera. It is proposed to raise \$125,000 to commence the street railway from Novato through San Rafael and Ross Valley towns to Corte Madera. It is estimated that \$65,000 must be raised to float bonds for the proposed railway.

**VALLEJO, CAL.**—The Board of Trustees have decided not to submit to the voters the proposition to issue \$144,000 in bonds for the construction of a municipal electric light plant.

**VALLEJO, CAL.**—Announcement has been made by the Vallejo Electric Light & Power Company of a reduction in the price of electricity from 11 to 8 cents per kw-hour, the change to take effect Jan. 1, 1911.

**GRANITE, COL.**—The Granite Tunnel Company, of Granite, Col., is reported to be contemplating the construction of a power plant in the near future. Electric generating machinery will be installed.

**GREELEY, COL.**—It is reported that farmers in the Oklahoma district, southwest of Greeley, working without irrigation, propose to water an extensive area by lifting water by electricity from Boyd Lake, a distance of 100 ft., to their lands.

**HAYDEN, COL.**—An electric light franchise has been granted by the Town of Hayden for a period of 25 years.

**MILLIKEN, COL.**—Arrangements are being made by the Northern Colorado Power Company for the erection of a large transformer station in Miliken, Col., from which electricity will be distributed to farms and adjacent towns.

**BRIDGEPORT, CONN.**—The B. F. Shaw Company, of Wilmington, Del., has been awarded the contract for the power plant of the Mal-  
leable Iron Company, of Bridgeport, Conn.

**WASHINGTON, D. C.**—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until July 25 for furnishing 32,000 ft. paper insulated submarine cable, type 321, and 8000 ft. type 327, both under signal corps specification No. 427. A. S. Cowan is captain of signal corps, United States Army.

**WASHINGTON, D. C.**—The Treasury Department, acting as trustee for all departments except the navy, awarded a contract for supplying the government with approximately 1,000,000 electric lamps. A joint award was made to the General Electric Company, the Columbia Incandescent Company and the Novelty Lamp Company, at a total cost of about \$170,000, which will result in a saving of about \$30,000 a year over the amount required before the specifications were standardized.

**ATLANTA, GA.**—Preparations are being made by the Atlanta & Carolina Railway Company to resume work on the construction of its proposed railway, which is to connect Atlanta, Augusta and Athens, with a branch line to College Park. It is reported that work will begin within 60 days. J. W. English, of Atlanta, Ga., is president of the company.

**AUGUSTA, GA.**—It is reported that W. H. Ellis, 1303 Fifteenth Street, Augusta, Ga., would like to receive estimates on electrical equipment for an \$18,000 church.

**CARTERSVILLE, GA.**—It is stated that the Government may soon commence work on construction of a large dam on the Coosa River, to furnish power to parties who recently purchased the property and

power rights at a receivers' sale, surveys for which have already been made. It is proposed to develop 15,000 hp and to construct an electric railway connecting Rome, Cartersville, Canton and other places in Georgia.

**MACON, GA.**—The Georgia Southern & Florida Railway Company has contracted with the Central Georgia Power Company to supply electricity to operate all machinery in the Macon shops.

**BURKE, IDAHO.**—The Marsh Mining Company, which is operating near Burke, Idaho, is reported to be contemplating the installation of a concentrating plant and considerable ore-reduction machinery. The present plant of the company is operated by electricity. C. L. Colwell, of Missoula, Mont., is president of the company.

**HAILEY, IDAHO.**—The Eureka Development Company is reported to be preparing plans for the construction of an electric power plant to furnish electricity to operate the machinery in its mines.

**KOOSKIA, IDAHO.**—The Department of the Interior has granted the Kooskia Land & Power Company permission to construct a dam on the Clearwater River, in what is now a national forest. The company, it is said, proposes to erect a hydroelectric power plant with an output of from 4500 to 5000 kw. When the plant is completed a number of industrial projects will be established.

**SALMON, IDAHO.**—Plans are being prepared by the Redrock & Salmon River Telephone Company for improvements and extensions to its system.

**ALEXIS, ILL.**—Contracts have been signed for the construction of a branch line of the Rock Island Southern Railway, the electric line between Rock Island and Monmouth. In order to secure the extension the Business Men's Club was obliged to purchase the entire right of way and to guarantee the sale of \$50,000 in bonds.

**DECATUR, ILL.**—The Decatur Southern Traction Company is reported to have completed preliminary arrangements for the construction of an electric railway from Decatur, Ill., south through Macon and Assumption to Pana, a distance of 30 miles, for which contracts will be awarded about Aug. 1. R. McCalman, 318 Citizens' T. & T. Building, Decatur, Ill., is chief engineer.

**GALENA, ILL.**—The H. M. Bylesby & Company, of Chicago, Ill., are reported to have purchased the electric generating plant and distributing systems owned by the Interstate Light & Power Company, with headquarters in Galena, Ill., and which furnishes electrical service in a territory of 200 square miles in the lead and mining fields of southwestern Wisconsin and northwestern Illinois. The company also furnishes electricity in Galena, Ill., Platteville, Cuba City, Benton and Hazel Green, Wis.

**MENDOTA, ILL.**—The construction of an electric interurban railway to connect Princeton and Mendota, via Dover and La Moille, is under consideration. J. Kendall, of La Moille, and A. R. Unholz, of Princeton, are interested in the project.

**PALATINE, ILL.**—The necessary funds (\$100,000) have been secured to insure the construction of the new electric railway from Palatine through Lake Zurich to Wauconda, and work on surveys will begin in the fall. Electricity for operating the proposed railway will be secured from the North Shore Electric Company.

**PEORIA, ILL.**—The City Council has granted the Peoria & Galesburg Railway Company a franchise to construct and operate an electric railway in Peoria.

**PITTSFIELD, ILL.**—The capital stock of the Pike County Telephone Company has been increased from \$75,000 to \$100,000.

**PULLMAN, ILL.**—The power house of the Pullman Company, at Pullman, Ill., is reported to have been destroyed by fire on July 17.

**ST. CHARLES, ILL.**—The City Council has granted a franchise to the Chicago, Wheaton & Western Railway, Heat & Power Company to construct and operate an electric railway in St. Charles, Ill.

**CONNERSVILLE, IND.**—It is reported that preliminary arrangements have been completed for the construction of an electric interurban railway to connect Connersville and Hamilton. C. L. Henry is interested in the project.

**CRAWFORDSVILLE, IND.**—Contracts have been awarded by the City Council for electrical equipment for the new municipal electric light plant. The contract for the building will be awarded soon. The cost of the plant complete is estimated at about \$100,000.

**INDIANAPOLIS, IND.**—The Indianapolis Telephone Company has purchased a site in West Indianapolis and will erect a building and install an automatic switchboard. The cost of the work is estimated at \$50,000.

**INDIANAPOLIS, IND.**—The Trustees of Woodruff, a resident corporation, have entered into a contract with the Merchants' Heat & Light Company for lighting that district. It is said that a radical change will be made in the near future in the lighting system of the drives.

**INDIANAPOLIS, IND.**—An ordinance has been introduced in the City Council requiring all railroads to pay the cost of maintaining electric lamps at points where streets are crossed by railroad tracks. This will involve a large amount, as 19 steam railroads and 12 electric railways enter Indianapolis.

**MADISON, IND.**—The Southern Indiana Traction Company is contemplating the construction of a power plant in Madison, Ind. J. E. Greeley is vice-president. The company proposes to construct an interurban electric railway to connect Madison and Scottsburg.

**MARION, IND.**—The City Council is reported to have passed an ordinance revoking the franchise granted the Indiana Gas & Electric Company, of New Jersey, Sept. 18, 1908. The local field is now open to any company wishing to secure a franchise.

**MARTINSVILLE, IND.**—We are informed that the city is contemplating improvements to the municipal electric plant, which will involve an expenditure of about \$10,000. H. K. Johnson is engineer.

**MICHIGAN CITY, IND.**—The Chicago, Lake Shore & South Bend Electric Railway Company has announced that it proposes to furnish electricity at reasonable rates for lamps, heat and motors at any and all points long its line, also to farmers. The company is planning to install additional equipment in its power house in this city, which will involve an expenditure of about \$140,000. Wire will be purchased for the erection of a special circuit.

**MUNCIE, IND.**—Arrangements are being made by the American Steel & Tin Plate Company for remodeling and enlarging its local factory, which will include the installation of a large amount of new machinery and electrical apparatus.

**NEW ALBANY, IND.**—The City Council has granted the Louisville & Southern Indiana Traction Company, a franchise to extend its railway to the proposed new fair grounds. It is expected that the system will be extended from New Albany to Frenck Lick Springs.

**NEW ALBANY, IND.**—Negotiations are under way between the Board of Public Works and the New Albany Gas & Electric Company for lighting the streets of the city. The new contract is for a term of 10 years, under which the company is to furnish arc lamps at the rate of \$52.25 each per year. Under the present contract the city pays \$58.20 per lamp per year. Under the new arrangements the railroad companies will be required to pay for lamps at the railroad crossings.

**OOLITIC, IND.**—The plant and holdings of the Social Home Telephone Company of Oolitic, Ind., has been purchased by Frank F. Bingham, of Bedford, Ind. It is understood that the new owner will make improvements and extensions to the property.

**SOUTH BEND, IND.**—A general improvement company has been organized by local capitalists for the purpose of constructing an electric railway, terminals and a bridge across the Willapa River. The capital stock is placed at \$2,000, and the incorporators are: F. L. Gaudett, J. W. Kleebe, W. Hammond and C. B. Weatherwax, of South Bend, Ind.

**SYRACUSE, IND.**—The Syracuse Cement Company is reported to have awarded the contract for the construction of a dam across the Elkhart River to Wilcutts & Hoover, of Marion, Ind. It is understood that the water power will be utilized to generate electricity for lamps and motors.

**TIPTON, IND.**—The City Council is reported to have appointed a committee to look into the question of replacing the present arc lamp street lighting system with incandescent lamps and secure the cost of same.

**DUBUQUE, IA.**—It is reported that plans are being prepared by the Dubuque Packing Company for the construction of a new factory, 80x185 ft. which will be equipped for electrical operation.

**IOWA FALLS, IA.**—The Iowa Central Telephone Company has purchased the plant and holdings of the Iowa Telephone Company, operating telephone lines between and exchanges in Eagle Grove, Hampton and Iowa Falls. The transaction involves about \$85,000; the purchasing company assumes the debts and bonds of the Iowa Telephone Company.

**JANESVILLE, IA.**—The Royer-Myers Manufacturing Company, recently organized with a capital stock of \$25,000, to manufacture gasoline engines, concrete mixers, etc., is reported to be preparing plans for the construction of a factory building, 40x100 ft. It is understood that the plant will be equipped for electrical operation.

**MARSHALLTOWN, IA.**—The contract for the installation of electroliters on Main Street is reported to have been awarded to the Buchanan-Boughton Company.

**WATERLOO, IA.**—The Waterloo, Cedar Falls & Northern Railway Company has awarded a contract to James Maine & Sons for the construction of its new power house in Waterloo. The building will be 154x132 ft. and will adjoin the present station. The cost of plant is estimated at about \$300,000.

**BELLEVILLE, KAN.**—Surveys have been completed and contracts for construction will soon be awarded by the Motor Grand Traction Company on 65 miles of its proposed 165-mile railway to connect Chester, Neb., and Wichita, Kan. E. S. Alnutt, of Canton, Kan., is president.

**KANSAS CITY, KAN.**—The Kansas City Commissioners have adopted a resolution to ascertain the cost of acquiring an electric light plant and operating the same as a municipal enterprise. Electrical service is now furnished by the Kansas City Consolidated Electric Light & Power Company.

**COLSON, KY.**—The Colson Telephone Company, recently organized, is contemplating the erection of a telephone exchange in Colson and telephone lines to Jeremiah and Indian Bottom. James Brown is interested in the project.

**GLENDANE, KY.**—The Glendane Telephone Company, recently organized is preparing to erect telephone lines from Glendane to Marydell and Bergen.

**HORSE CAVE, KY.**—We are informed that the Horse Cave & Eastern Railway Company will commence work on construction of its proposed electric railway as soon as the preliminary engineering work has been completed. The railway will be 25 miles in length and will connect



Horse Cave, Hiseville, Knob Lick and Edmonton. Either gasoline or gasoline-electric cars will be operated for passenger service and steam for freight. Louis Edwards, 1463 Arlington Avenue, St. Louis, Mo., is general manager.

**LEITCHFIELD, KY.**—Oelze Brothers, of Owensboro, Ky., are reported to have purchased a franchise for an electric light plant and water works system in Leitchfield. Work may commence on the electric plant in August or early in the fall.

**LOUISVILLE, KY.**—The Louisville Railway Company is reported to be making preparations for building an extension to its system in Louisville to give East and South Louisville a direct railway service with West Louisville and Parkland.

**MAYSVILLE, KY.**—It is reported that an election will be held to vote on the proposition to issue \$75,000 in bonds, the proceeds to be used for the construction of an electric light plant and to secure natural gas in Maysville.

**MURRAY, KY.**—It is reported that the Murray Traction Company will place contracts about Sept. 1 for the construction of its proposed railway to connect Murray and Calloway, a distance of about 16 miles, for which, it is said, surveys have been completed and most of the right of way secured. Nathan Ryan, of Murray, Ky., is president.

**WASIOTO, KY.**—The Cumberland River Telephone & Telegraph Company, recently organized, contemplates the erection of a local telephone system and long-distance lines in the Cumberland Valley. The company is capitalized at \$25,000. B. N. Worthington is interested in the company.

**NEW LIBERIA, LA.**—The Southwestern Traction & Power Company is reported to be interested in a project to construct an electric railway in New Iberia and vicinity. F. W. Crosby, of New Orleans, La., is promoter of the enterprise.

**NEW ORLEANS, LA.**—The New Orleans Railway & Light Company has purchased the franchise for the Spanish Fort extension of the West End Railroad and will build the railway, including the bridge over bayou St. John.

**NEW ORLEANS, LA.**—The Consumers' Electric Company is reported to have awarded a contract to Otis W. Sharp, of New Orleans, La., for the erection of concrete and steel building for substation. The equipment will include a 500-kw motor-generator set, with necessary switchboard and cable connections, for which contract has been awarded.

**NEW ORLEANS, LA.**—Plans are being considered for an extension of the Royal Blue Line of the New Orleans Railway & Lighting Company to Shreveport. The residents of Jefferson Parish, it is reported, are willing to raise the funds for building the extension, provided the New Orleans company will furnish the rolling stock. The money will eventually be returned to the contributors with interest.

**BANGOR, MAINE.**—The Bangor & Northern Railroad Company is installing a motor-generator set in its Kenduskeag power station, which will greatly increase the output of the plant.

**BANGOR, MAINE.**—The Bangor Railway & Electric Company has entered into a contract with the Eastern Maine Insane Hospital to furnish electricity for lamps and motors for the hospital. The company is planning to install a motor-generator set to increase the output of its plant to provide for the hospital service.

**DEXTER, MAINE.**—Fay & Scott are reported to be making preparations to utilize the water power at Libby's Mills to furnish power to operate their large machine shops. This power was formerly utilized by the Dexter Electric Company, until it erected a steam power plant in Dexter.

**BALTIMORE, MD.**—Samuel T. Williams, 223 North Calvert Street, Baltimore, Md., is reported to be in the market for a 50 to 65-kw, 220-volt, three-phase, 60-cycle, alternating-current generator direct-connected or belted with a Corliss type engine; a 10-kw, 220-volt, direct-current, direct-connected or belted unit, and also a 10-kw, 100-volt, direct-connected set.

**ADAMS, MASS.**—The Renfrew Manufacturing Company is installing a 134-kw generator to supply electricity for its jacquard mill.

**ATTLEBORO, MASS.**—Announcement has been made by the Attleboro Steam & Electric Company of a reduction in the price of electricity for lamps from 15 to 14 cents per kw-hour, which applies to both commercial and residential service, Edgar Treggion is manager of the company.

**MARLBORO, MASS.**—The State Railroad Commissioners have granted the Boston & Western Electric Railway Company a certificate of necessity for the construction of an electric railway beginning in Waltham and extending through Weston, Wayland and Sudbury to Marlboro.

**MEDFORD, MASS.**—Mayor Brewer has signed a new 10-year contract with the Malden Electric Company for lighting the streets of the city. Under the terms of the contract the company is to furnish 592 incandescent lamps at \$14.12 each per year, and 162 arc lamps at \$76.63 per lamp per year. The company also agrees to replace the present 25-cp incandescent street lamps with 40-cp tungsten lamps. Provision is also made for a reduction in price and for furnishing of improved type of lamp or apparatus by the company in the event that another municipality shall make a more advantageous or lower priced contract with the company. The contract dates back to March 1 and abrogates a previous agreement made July 20, 1907.

**MERRIMAC, MASS.**—Beginning July 1 a new schedule of rates for

electricity for lamps and motors went into effect, as follows: For electricity for lamps a minimum charge of \$10 per year will be made; bills over \$10 per year will be rendered at 20 cents per kw-hour, with discount on net bills for one year according to the amount used; on bills over \$10 and under \$20 a discount of 25 per cent will be allowed; over \$20 and less than \$40, 35 per cent discount; over \$40 and less than \$75, 40 per cent discount; over \$75 and less than \$100, 45 per cent discount; over \$100 and less than \$250, 50 per cent discount; on bills over \$250 special rates will be given. When the consumer's bill is estimated to exceed \$10 per year net, no monthly bills will be rendered until the meter shows 5 or more kw. Energy for motors will be charged at the following rates for yearly bills. For 250 kw or less \$18; over 250 kw and less than 1500 kw, eight cents per kw-hour, or 1500 kw for \$105; over 1500 kw, and less than 2500 kw, seven cents per kw-hour, or 2500 kw for \$150; over 2500 kw, and less than 5000 kw, six cents per kw-hour, or 5000 kw for \$250; over 5000 kw, and less than 10,000, five cents per kw-hour, or 10,000 kw for \$450; over 10,000 kw and less than 15,000 kw, four and one-half cents per kw-hour, or 15,000 kw for \$600; over 15,000 kw, and less than 35,000 kw, four cents per kw-hour, or 35,000 kw for \$1,225; over 35,000 kw, and less than 50,000 kw, three and one-half cents per kw-hour, or 50,000 kw for \$1,500; over 50,000 kw, and less than 100,000 kw, three cents per kw-hour. Special rates to consumers using over 100,000 kw.

**WORCESTER, MASS.**—The Wyman & Gordon Company is reported to be contemplating equipping its plant for electrical operation, and is said to be negotiating with the Worcester Electric Light Company to supply electricity to the amount of 300 hp.

**WORCESTER, MASS.**—Preparations are being made by the Crompton & Knowles Loom Company to operate its plant by electricity instead of by steam power. The company has recently contracted with the Worcester Electric Light Company for electrical power to the amount of 400 hp.

**WORCESTER, MASS.**—The stockholders of the Worcester Electric Light Company have voted to make application to the State Gas and Electric Light Commissioners for permission to issue 2000 shares of capital stock, making the total capitalization \$1,000,000. The proceeds will be used for the construction and equipment of the new plant to be erected on Webster Street. George T. Dewey is president of the company.

**COLDWATER, MICH.**—The Water Board is reported to be contemplating the purchase of a power pumping system for the water-works. W. H. Frederick is superintendent of the municipal electric light and water plant.

**DETROIT, MICH.**—The Anderson Forge & Machine Company is making arrangements to install a 250-kw and a 125-kw, 60-cycle, three-phase, 240-volt alternator manufactured by the Allis-Chalmers Company, of Milwaukee, Wis., in its new plant, now under construction.

**DETROIT, MICH.**—A new automobile factory is being erected at 1256 Jefferson Avenue, Detroit, Mich., by Frederick E. Wadsworth and H. Scherer. The building will be 65x631 ft., and will be equipped for electrical operation. A sprinkler system will be installed.

**GLADSTONE, MICH.**—The Northwestern Cooperage & Lumber Company is making plans to increase the output of its plant and flouring mill. Orders have been placed by the company with the Allis-Chalmers Company, of Milwaukee, Wis., for a 500-kw, 480-volt, three-phase, 60-cycle alternator, with exciter and 36 squirrel cage induction motors and switchboard.

**IRONWOOD, MICH.**—The City Council has passed an ordinance granting franchises to Albert D. Johnston, Florence D. Sullivan and Manuel M. Reid to construct and operate an electric light plant and street railway system in Ironwood, Mich. The franchises are for a term of 30 years, at the expiration of the franchise for the electric plant the city has the privilege of purchasing same, the price to be determined by a committee appointed by the City Council and the company. Under the terms of the franchise the plant is to be in operation by July, 1911. The maximum charge for electricity to private consumers is 10 cents per kw-hour with a discount of 5 per cent if paid within 10 days. The company agrees to furnish electricity for the municipal buildings and school houses in Ironwood for six cents per kw-hour, subject to a discount of 5 per cent if paid within 10 days from date of bill. Arc lamps for street lighting are to be furnished at the rate of \$60 per lamp per year. It is understood that a street lighting contract for a term of 10 years has been awarded the company.

**LANSING, MICH.**—Contracts have been closed with the W. H. Zimmerman Company, of Chicago, Ill., for the engineering and construction work in connection with the electric interurban railway from Lansing to Grand Ledge, Mich., 12½ miles in length. The third-rail system will be used. Arrangements will be made to enter Lansing over the tracks of the Michigan United Railways Company. The new railway will furnish both passenger and freight service, and will ultimately be extended from Grand Ledge to Grand Rapids.

**ANOKA, MINN.**—Contracts have been awarded by the Water and Light Commissioners for equipment for the municipal water and light plant as follows: To the Allis-Chalmers Company, of Milwaukee, Wis., for a 250-hp compound engine direct-connected to a 175-kw generator, and to R. B. Whitaker & Company, of St. Paul, Minn., for two 150-hp water-tube boilers, at a cost of \$20,000.

**FARIBAULT, MINN.**—The Consumers' Power Company has recently installed an ornamental curb lighting system, covering 11 blocks in the

business district in Faribault. When the gas and electric properties in Faribault were purchased by H. M. Bylesby & Company, a contract was made with the city to install an ornamental lighting system. There are 106 standards, each bearing three 40-watt tungsten lamps. All three lamps burn from dusk to midnight and one lamp all night.

**GRANITE FALLS, MINN.**—At an election held July 15 the proposition to issue \$40,000 in bonds, the proceeds to be used for improvements to the municipal electric plant, water works system, was carried. Henry L. Kaselin is city clerk.

**ST. PAUL, MINN.**—Plans are being prepared for the construction of a 30-ft. dam across the Mississippi River, opposite Fort Snelling, which was authorized by the last Congress. The cost of the dam is estimated at \$250,000. Additional funds will be required for power house and equipment. Major Francis R. Shunk, in charge of the United States engineers' office at St. Paul, Minn., is preparing plans.

**STAPLES, MINN.**—Sealed proposals will be received by the City Council, Staples, Minn., until July 26 for the construction of a heating plant as an extension to the municipal light plant in this city, plans and specifications for which are on file at the office of F. W. Findsen, city clerk.

**VIRGINIA, MINN.**—It is reported that the city is considering the purchase of the light and water plants of the Virginia Electric Power & Water Company, to be operated by the municipality.

**GREAT FALLS, MONT.**—The first two units of 6000 hp each of the Rainbow Falls development at Great Falls, Mont., has recently been put in operation. It is expected to have the other four units of 6000 hp each of this plant ready to place in operation some time in August. The Rainbow Falls has a fall of 54 ft. and is the second largest of the five falls in the Missouri River at Great Falls. There is an aggregate drop of 535 ft. in the Missouri River within five miles, with a total possible development of about 330,000 hp. Charles T. Main, of Boston, Mass., is engineer in charge.

**LIBBY, MONT.**—Investigations have been made recently by Stanton E. Barnum and C. Proctor, of Great Falls, Mont., in Libby, with a view of asking a franchise from the City Council to construct a gravity water system and to install an electric light system. The parties are negotiating with the telephone company to take over the telephone franchise granted some months ago.

**MILES CITY, MONT.**—Plans are being prepared for improvements to the municipal electric light plant, water-works and sewer systems, to cost \$30,000. Burns & McDonnell, of Kansas City, Mo., are consulting engineers.

**CARTHAGE, MO.**—The Empire District Electric Company, of Joplin, Mo., is reported to be contemplating the construction of a substation in Carthage, Mo. Electricity for operating the station will be supplied from the hydroelectric power plant at Lowell. The company will furnish electrical service to manufacturing plants, including the quarries.

**DE SOTO, MO.**—The City Council is reported to be considering the question of installing an electric lighting system in connection with the water works plant.

**GREENFIELD, MO.**—The Greenfield Light & Power Company is planning to enlarge and increase the output of its plant. The new equipment will include a 100-kw, 2300-volt, three-phase, 60-cycle belted alternator, manufactured by the Allis-Chalmers Company, Milwaukee, Wis.

**KANSAS CITY, MO.**—The Metropolitan Street Railway Company has accepted a franchise requiring it to extend its railway from the terminus of the Quindaro Boulevard line west to Twenty-second Street and thence north to Brown Avenue.

**ST. LOUIS, MO.**—The contract for the installation of the electric conduit system in the St. Louis post office has been awarded by James F. Knox Taylor, supervising architect, to the Newberry Electric Company, of St. Louis, Mo., for \$15,588.

**ST. LOUIS, MO.**—W. S. Markle, consulting engineer, 1005 New Bank of Commerce Building, St. Louis, Mo., is reported to be in the market for electrical equipment, including a 225 to 300-kw, two-phase, revolving field, 2300-volt, 60-cycle direct-connected generator; also Corliss engine and exciter for same; a 50 to 75-kw, 2300-volt, three-phase, 60-cycle, revolving-field generator, either belted or direct connected with engine and exciter.

**BEATRICE, NEB.**—It is reported that E. J. Sullivan, of Omaha, Neb., has purchased the plant and holdings of the Beatrice Electric Company. It is understood that the new owner will make extensive improvements to the system.

**BROKEN BOW, NEB.**—Preparations are being made by the Broken Bow Electric Light Company for the construction of a new power house in Broken Bow.

**FREMONT, NEB.**—The City Council has granted the Nebraska Traction & Power Company a franchise to construct an electric railway in the City of Fremont, under which the railway is to be completed by Jan., 1912.

**LEXINGTON, NEB.**—The electric plant of the Lexington Mill & Elevator Company, which furnishes electrical service in Lexington, was destroyed by fire recently, causing a loss of about \$7,000.

**OMAHA, NEB.**—The contract for construction of the new power house of the Omaha & Council Bluffs Street Railway Company has been awarded to McGowan & Jacobberger. The Wisconsin Bridge & Iron Company

has the contract for structural steel. The new building will be located at Fifth and Jackson streets, the cost of which with equipment is estimated at \$600,000.

**EAST TILTON, N. H.**—The Stone & Webster Engineering Corporation, of Boston, Mass., consulting engineer for the Laconia Electric Lighting Company, of Laconia, N. H., has purchased three 250-kw, 6600-volt, three-phase, 60-cycle alternators from the Allis-Chalmers Company, of Milwaukee, Wis., which will be direct connected to hydraulic turbines. Each alternator will be independently excited by a 12-kw coupled exciter.

**CRANFORD, N. J.**—At a town meeting held July 8 the citizens decided in favor of municipal ownership of its water system and electric light plant. Resolutions were passed authorizing the township committee to appoint a commission to take charge of the matter and secure an engineer to determine the best course to pursue. It was also recommended that bonds be issued to defray preliminary expenses.

**EATONTOWN, N. J.**—The question of establishing an electric lighting system in Eatontown is under consideration. The Shore Electric Company of Red Bank, N. J., has a franchise to extend its transmission lines to this town.

**PERTH AMBOY, N. J.**—The East Jersey Light & Power Company, recently incorporated with a capital stock of \$1,500,000, it is said, will purchase electric power plants in Southern New Jersey in a territory not reached by the Public Service Corporation of New Jersey. The company has already purchased plants in Freehold and Englishtown, and is negotiating for the purchase of the systems of the Princeton Light, Heat & Power Company, of Princeton, the Deal Beach Light & Water Company and the Electric Light & Power Company of Hightstown, N. J., and several other plants in Monmouth and Mercer counties. William J. Lansley, of Perth Amboy, N. J., is consulting engineer.

**SALEM, N. J.**—The Salem Electric Company is reported to have purchased property on the water front in Salem, N. J., where, it is said, the company proposes to erect a power plant, with an output of three times the present plant.

**AMSTERDAM, N. Y.**—The Common Council has granted the Fonda, Johnstown & Gloversville Railroad Company, a franchise to double-track its railway on Main Street in Amsterdam and to construct a belt line.

**BOONVILLE, N. Y.**—W. G. Stone, hydraulic engineer, of Utica, N. Y., is reported to be preparing plans for the construction of a concrete dam in connection with the municipal electric plant in Boonville, N. Y. The cost of the dam is estimated at \$15,000.

**BROOKLYN, N. Y.**—The Public Service Commission, First District, has adopted a resolution laying out a rapid transit route in Utica Avenue, Brooklyn, south from the Eastern Parkway to a point in Flatbush Avenue, near Jamaica Bay. It is proposed to construct this route upon the assessment plan.

**BUFFALO, N. Y.**—The Niagara & Erie Power Company, which is controlled jointly by the Buffalo & Lake Erie Traction Company and the Niagara, Lockport & Ontario Power Company has applied to the Public Service Commission, Second District, for permission to issue \$100,000 in capital stock and \$500,000 in bonds, with a mortgage to bondholders, which will permit increasing the bond issue to \$1,250,000. The company proposes to erect transmission lines for the purpose of furnishing electricity generated at Niagara Falls to Dunkirk, Westfield, Jamestown and other towns through the grape belt, possibly extending as far west as Erie. The Niagara, Lockport & Ontario Power Company now furnishes electricity in West Seneca, its transmission line from Niagara Falls circling the city meeting the Buffalo & Lake Erie Traction Company's right of way in West Seneca, which company has rights of way to cities and towns along the lake shore and to Jamestown by a railroad, which it controls.

**ELMIRA, N. Y.**—Preparations are being made by the Elmira Water, Light & Railroad Company for extensive improvements and extensions to its plant on Madison avenue, including the installation of two new boilers of 600 hp, contract for which has been placed with the Babcock & Wilcox Company, of New York, N. Y.

**EPHRATAH, N. Y.**—The Mohawk Electric Company has received authority from the Public Service Commission, Second District, to construct a hydroelectric power plant on Garoga Creek in Fulton County, and also to exercise rights and privileges under a franchise granted by the Town Board and superintendent of highways of the Town of Ephratah. A large portion of electricity generated at the plant will be sold to the Fulton County Gas & Electric Company, of Johnstown, N. Y.

**FULTONVILLE, N. Y.**—The Cayadutta Generating Company has been granted permission by the Public Service Commission, Second District, to take the rights and franchises granted by the Village of Fultonville and the Village of Fonda, to Adam Z. Wemple and J. S. Wilson for the construction and operation of electric lighting systems in both towns. The company is authorized to exercise its rights and privileges granted in the franchises and to construct and maintain conduits and distributing systems in the villages of Fonda and Fultonville. The company has been authorized to issue \$30,000 in capital stock, the proceeds to be used for the purchase of the above property; also to execute a mortgage in favor of the Schenectady Trust Company to the amount of \$30,000 to secure an issue of bonds of same amount, to be sold at not less than 90.

**GLENS FALLS, N. Y.**—The Public Service Commission, Second District, has authorized the Mohawk Hydro-Electric Company to execute a

mortgage on its property and franchises to secure an issue of \$3,000,000 in bonds, and to issue \$675,000 in capital stock. The company is also authorized to issue \$932,000 in bonds, secured by the above mortgage, to be sold at not less than 88, the proceeds to be used for payment of lands and water rights on the Peck and Garoga Lakes and along Garoga Creek, engineering fees, etc., and for construction of dams, pipe line, power house, machinery, and sundry organization expenses.

**INDUSTRY, N. Y.**—Bids will be received by Miss Lura E. Aldridge, president Board of Managers, of the State Agriculture & Industrial School, Industry, N. Y., until Aug. 9, for electric feeder cables, poles and transformers for the State Agricultural & Industrial School. Plans and specifications may be consulted and blank forms of proposal obtained at the State Agricultural & Industrial School, Industry, N. Y., and at the office of Franklin B. Ware, state architect, Albany, N. Y., where plans and specifications can also be secured.

**NEW YORK, N. Y.**—The contract for completing the electric equipment on school No. 101, Borough of Manhattan, contract for which had been declared abandoned, has been awarded to Cowden & DeYoung, 45 East Forty-second street, New York, N. Y., for \$7,583. C. B. J. Snyder is superintendent of schools.

**NEW YORK, N. Y.**—The Public Service Commission has granted the application of the Manhattan Bridge Three-Cent Line for a certificate of public convenience and necessity for an electric railway from a point near Atlantic Avenue and Flatbush, Brooklyn, to a point at or near the Desbrosses Street ferry, in Manhattan, by the way of the Manhattan Bridge.

**NEW YORK, N. Y.**—The New York Electric Lines Company has applied to Henry G. Thompson, commissioner of the Department of Water, Gas and Electricity, for permission to place its wires in the subways controlled by the Consolidated Electrical Company and the Empire Subway Company, which are owned by the city. The New York Electric Lines Company proposes to operate light, power, telephone and telegraph lines.

**ROCHESTER, N. Y.**—The Livingston-Niagara Power Company has applied to the Public Service Commission, Second District, for permission to begin construction and approval of the exercise of franchises held by the company in Livingston County; also for authority to execute a mortgage upon its properties for \$350,000 to secure an issue of bonds of the same amount and to issue capital stock to the amount of \$100,000.

**HICKORY, N. C.**—Announcement has been made by M. E. Thornton, president of the Thornton Light & Power Company, Hickory, N. C., that arrangements have been completed for financing its proposed hydro-electric power plant on the Catawba River, where 8000 hp will be developed for transmission. The company proposes to supply electricity for railways, lighting and industrial purposes.

**BISMARCK, N. D.**—The Hughes Electric Company is reported to be constructing a new electric plant, the equipment of which will include boilers with mechanical stokers, an 800-hp cross-compound engine and an electric generator.

**FARGO, N. D.**—At an election held July 6 the citizens voted to issue \$35,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant.

**AKRON, OHIO.**—Preparations are being made by the Northern Ohio Traction & Light Company, of Akron, Ohio, for the construction of a new power plant in this city. Plans are now being prepared and it is expected that bids will be called for in the near future. The cost of the entire plant is estimated at about \$2,000,000.

**HAMILTON, OHIO.**—Arrangements are being made by the Mosler Safe Company, of Hamilton, Ohio, for increasing the output of its power plant. The company has recently placed orders with the Allis-Chalmers Company, of Milwaukee, Wis., for a 200-kw, 240-volt, 425 r. p. m. generators.

**ADA, OKLA.**—The McKenna Construction Company, which is promoting the construction of an interurban electric railway between St. Louis, Mo., and Oklahoma City, Okla., has secured water rights for a power plant at Ada, Okla. The proposed railway will be equipped with modern sleeper coaches.

**PORTLAND, ORE.**—The United Railways Company, of Portland, Ore., has awarded a contract to Porter Brothers for the construction of an electric railway from Burlington to Glencoe, a distance of 11 miles. Contract for substation equipment was awarded to the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa. The company is reported to have asked for bids for the construction of the railway from Glencoe to Bay City, 56 miles in length.

**McCALL FERRY, PA.**—It is reported that the Pennsylvania Water & Power Company is contemplating the duplication of its hydroelectric generating plant on the Susquehanna River at McCall Ferry, Pa., with a view to doing away with the expense of constructing and maintaining an auxiliary steam power plant.

**NEW CASTLE, PA.**—Plans are being considered by the New Castle, New Wilmington & Sharon Railway Company for the construction of an electric railway to connect New Castle, New Wilmington, and West Middlesex, a distance of 15 miles. James Campbell is interested in the project.

**SCRANTON, PA.**—The Delaware, Lackawanna & Western Railroad Company has recently placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for six 200-kw, three-phase, three 200-kw, single-

phase, two 150-kw, three-phase and one 100-kw, single-phase, oil-filled, self-cooled transformers. The transformers will be installed in collieries and washeries at Scranton, Nanticoke and Taylor, Pa.

**GREENVILLE, S. C.**—The City Council has granted the Home Light & Power Company, of Greenville, S. C., a 30-year franchise in this city. A. E. Sussex is city clerk and treasurer.

**HONEA PATH, S. C.**—The City Council is reported to have engaged J. B. McCrary & Company, consulting engineers, of Atlanta, Ga., to make surveys and prepare plans for the construction of an electric light plant in Honea Path, S. C.

**PIERRE, S. D.**—Bids will be received by T. C. McNamee, clerk of the Board of Education, Pierre, S. D., until Aug. 8 for the construction of power house, installation of heating plant and plumbing; separate proposals for each. Plans and specifications for the above are on file at the office of the clerk of Board of Education, Pierre, S. D., and at the Builders' Exchanges in St. Paul and Minneapolis, Minn., and at the office of George Isenhuth, architect, Huron, S. D.

**RAPID CITY, S. D.**—Orders have recently been placed by the Dakota Power Company with the Allis-Chalmers Company, of Milwaukee, Wis., for three 100-kw and three 75-kw, oil-filled, self-cooled, 60-cycle, 20,000-2300-volt transformers.

**KNOXVILLE, TENN.**—Preparations are being made by the Knoxville Railway & Light Company for the construction of an extension to its power house, to cost about \$7,000, work on which will commence in the near future. A 3000-kw turbine will be installed, contract for which has been placed.

**PORT ARTHUR, TEX.**—Two applications for franchises to construct an electric interurban railway between Port Arthur and Beaumont, a distance of about 25 miles, are under consideration by the Board of County Commissioners of Jefferson County. One application was submitted by H. J. Meyers, president of the Port Arthur Traction Company, and the other by I. D. Polk, of Beaumont, Tex.

**SAN ANTONIO, TEX.**—M. Bargas Company, of San Antonio, Tex., it is reported, would like to secure estimates on electrical equipment.

**SNYDER, TEX.**—The Snyder Ice, Light & Power Company is reported to have awarded a contract for construction of power house in connection with its ice plant.

**SWEETWATER, TEX.**—The Council has granted a franchise to C. M. McLain, G. E. Romsey and W. E. Barrow, all of the Sweetheart, Tex., to construct and operate a street railway in this city.

**CISCO, UTAH.**—Plans are being prepared by the Hampson-Fielding Engineering Company, of Denver, Col., for the construction of a power plant for the Grand Valley Fruit & Water Company, at Cisco, Utah. The proposed plant will cost about \$300,000 and will furnish power and water for irrigation purposes.

**PROVO, UTAH.**—The Provo Electric Company has submitted a proposition to the City Council offering to sell its distributing system to the city for \$100,000. The city recently voted to issue bonds to the amount of \$110,000 for the construction of a municipal plant.

**RUTLAND, VT.**—The Rutland Railway, Light & Power Company has secured the entire right of way for its proposed extension from Fair Haven to Poultney.

**CAPE CHARLES, VA.**—The New York, Philadelphia & Norfolk Railroad Company has awarded the contract for power plant and other equipment for the new shops and roundhouse at Cape Charles, Va., to the B. F. Shaw Company, of Wilmington, Del.

**FALLS CHURCH, VA.**—We are informed that the Washington-Virginia Railway Company will commence work on the construction of its proposed electric railway to connect Washington, D. C., and Falls Church, Va. M. E. Church, of Falls Church, Va., is president and general manager.

**PULASKI, VA.**—The General Chemical Company has recently placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for two 40-hp direct-current motors.

**ELLENSBURG, WASH.**—Water rights have been filed by the Cle Elum Falls Power Company with the county auditor appropriating 5000 cu. in. of water per second from the Cle Elum River, to be used for generating electricity. J. C. Donnelly, of Tacoma, Wash., is president of the company.

**EVERETT, WASH.**—The Robinson Manufacturing Company has contracted with the Allis-Chalmers Company, of Milwaukee, Wis., for a 155-kw, 480-volt, three-phase, 60-cycle, 900 r. p. m. alternator, one 60-hp, one 40-hp and one 20-hp, squirrel cage induction motors, which will be installed in the new plant now being constructed by the company.

**LANGLEY, WASH.**—The Whidby Island Telephone Company is reported to be considering plans for extensive improvements to its system.

**PORT ORCHARD, WASH.**—Joseph E. Wickstrom is reported to have been granted a water and light franchise in Port Orchard.

**REPUBLIC, WASH.**—It is reported that the North Washington Power Company, which owns and operates a power plant in Republic, has leased the plant in Oroville, Wash., and proposes to build a transmission line 45 miles in length to this town.

**TACOMA, WASH.**—Owing to the warrant plan of paying the contractors for work in connection with the construction of the proposed substation of the Nisqually power plant no bids were submitted July 5. The cost of the station is estimated at \$95,000. It is said that the city officials may arrange to dispose of the warrants.

WENATCHEE, WASH.—The Farmers Telephone Company is reported to be contemplating increasing its capital stock from \$50,000 to \$150,000.

WENATCHEE, WASH.—Notice of appropriation of 800 cu. ft. per second of water from the Wenatchee River and 3000 cu. ft. per second from Lake Wenatchee has been filed by J. M. Thatcher. The water is to be used for power purposes.

FLEMINGTON, W. VA.—The County Court has granted W. J. Davidson and W. C. Wyckoff a franchise to construct and operate a street railway in the Town of Flemington, W. Va.

MORGANTOWN, W. VA.—Plans are being prepared for the construction of a concrete gravity dam across Deckers Creek, in connection with the power plant improvements to be made by the Union Utilities Company. H. R. Warfield is general manager of the company and V. F. Hammel, engineer in charge.

PETERSBURG, W. VA.—We are informed that the question of installing an electric light plant and water works system is not under consideration as was reported in these columns in the issue of June 23.

WELCH, W. VA.—The Davy-Pocahontas Coal Company, recently incorporated, is reported to have purchased 3400 acres of coal lands for development. The company, it is said, will install mining machinery, erect tipples, miners' dwellings and construct an electric power plant to supply electricity for lamps and motors, at a cost of about \$125,000. The initial installation will provide for about 1000 tons daily, which will be increased to 3000 tons. As yet no contracts have been awarded. Walter L. Taylor is president. The Baltimore offices are located at 509 Continental Trust Building.

MELLEN, WIS.—Plans are being considered by the Mellen Water & Light Company for improvements and extensions to its system, which will involve an expenditure of about \$30,000. If certain agreements are reached, for which negotiations are now under way, the company proposes to extend its mains, install additional pumps, sink wells for water and make other improvements, bids for which will be asked for in the near future. A. W. Pribnow is general manager.

MILWAUKEE, WIS.—The Phoenix Knitting Works is reported to be planning the erection of a six-story addition 80x120 ft. to its factory and a new power plant. It is understood that machinery, including a sprinkler system will be purchased in the near future.

WAUPUN, WIS.—Preparations are being made for remodeling and enlarging the municipal electric light plant, bids for which, it is said, are now being asked.

WAUPUN, WIS.—Arrangements are being made by the C. A. Shaler Company, of Waupun, Wis., for the construction of a factory building, which will be equipped for electric motor drive throughout. The company has not yet decided whether to install a power plant or purchase electricity from the municipal plant.

CALGARY, ALTA., CAN.—At an election to be held July 28 the by-law to appropriate \$125,000 for the construction and equipment of a municipal power plant will be submitted to a vote.

LEDUC, ALTA., CAN.—The municipality is contemplating establishing an electric light and power service in Leduc. The city officials are negotiating with the City of Strathcona to supply electricity from its municipal plant for lamps and motors in this town.

VANCOUVER, B. C., CAN.—The British Columbia Electric Railway Company is reported to have awarded a contract for grading the extensions of its North Vancouver lines in the Capilona district to McAlpine Roberts & Company, of Vancouver, B. C.

GRAND FALLS, N. B., CAN.—It is reported that arrangements have been made between the Grand Falls Power Company and William Van Horne and others interested in the property by which the latter will take over the plant and holdings of the old company and develop the water power at the falls.

GALT, ONT., CAN.—Contracts have been awarded for the distributing station in connection with the Hydro-Electric Power Commission project to the Packard Electric Company, of Warren, Ohio., and the Canadian General Electric Company, for \$9,104. The transmission line will be extended to Galt from the transformer station at Hespeler. The cost of installation of the incandescent street lighting system, together with the amount paid for the overhead distributing system purchased from the Galt Gas Light Company will make the total cost of installing the system for securing service from the Hydro-Electric Power Commission, about \$25,000.

KENORA, ONT., CAN.—The Reese Engineering Company is reported to have acquired the property and holdings of the Kewatin Power Company. The new owners, it is said, propose to supply several municipalities in Manitoba with electrical power. It is understood that the City of Brandon contracted with the company for 2500 hp at \$20 per hp per year, the service to commence December, 1911.

KINGSTON, ONT., CAN.—It is reported that the Seymour Power & Electric Company, of Campbellford, Ont., Can., has submitted an offer to supply electrical power in Kingston, at \$25 per hp per year.

LONDON, ONT., CAN.—Sealed tenders will be received by the Board of Water Commissioners, London, Ont., Can., until July 29, as follows: Section "A"—Two 3,000,000-gal. turbine pumps, 250-ft. head, 750 r.p.m. Section "B"—Two 250-hp, 750 r.p.m., self-starting synchronous motors with direct-connected exciters. Section "C"—Two 350-kva, three-phase, 13,200-2300-volt, self-cooled transformers. Section "D"—Switchboard

equipment for sections "B" and "C." Section "E"—Switchboard equipment for incoming and outgoing transmission lines, with lightning arresters, etc. Section "F"—One 25-kw, single-phase, self-cooled, 2300-110-volt lighting transformer. Frequency of all current 25 cycles. Form of tender, instructions to bidders, plans and specifications, may be obtained from O. Ellwood, secretary of Board of Water Commissioners, London, Ont., or from H. J. Glaubitz, consulting engineer, Continental Life Building, Toronto, Ont.

OTTAWA, ONT., CAN.—Sealed tenders will be received until July 26 for work required in connection with the Transcontinental Railway shops east of Winnipeg, Man., as follows: (1) Air, steam, water and oil piping system; (2) yard water system; (3) pipe tunnels and wiring ducts. Plans and specifications may be seen at the office of Gordon Grant, chief engineer of the Commissioners, at Ottawa, Ont., and the office of S. R. Poulin, District engineer, St. Boniface, Man., P. E. Ryan is secretary of the Commissioners of the Transcontinental Railway.

YORKTON, SASK., CAN.—A resolution has been passed by the Town Council authorizing the preparation of a by-law calling for an expenditure of \$35,000 for a municipal electric light plant.

HOSTOTIPAQUILLO, JALISCO, MEX.—Plans are being considered by the Cinco Mines Company for the construction of an electric railway from its property, in this district, to the railroad shipping point at Magdalena. The proposed railway will run through the mountains and will afford transportation for other mines and industries of the district.

MEXICO CITY, MEX.—Preliminary steps have been taken during the last few months toward the installation of many hydroelectric power plants in different parts of the republic, for which a number of applications for government concession are now pending. Albert B. Fall has applied for a government concession to use 14,000 gal. of water per second from the Aros River in the Guerrero district, State of Chihuahua, to be utilized to generate electricity for use in mines. Plans have been prepared for the proposed hydroelectric power plant, work on which will begin as soon as the concession is granted. A concession has been asked for from the government by D. J. Spillane to use the water from the falls of the Hallinas River in the Santa Maria del Rio district, State of San Luis Potosi, to operate a hydroelectric power plant. Electricity generated at the plant will be transmitted to mining and industrial centers in that region. The La Cruz Mining & Milling Company has made application for a concession to use 314 gal. of water per second from the Navosaigame River, in the State of Chihuahua, the water power to be used to generate electricity to operate the machinery in the mines and mills of the company. Application has been made by M. Dahgren for permission to use 16,000 gal. of water per second from the Champayan Lagoon in the State of Tamaulipas to irrigate a large tract of land in his San Francisco hacienda. In many instances the applications are for power and irrigation projects combined.

MONTEREY, MICH., MEX.—Contracts have been placed by the Monterey Railway, Light & Power Company, with the Allis-Chalmers Company, of Milwaukee, Wis., for a 100-hp 220-volt, three-phase, 60-cycle, squirrel cage induction motor and three 50-kw transformers. The motor will be connected with one of the pumps which supply the water system. The Monterey company has a concession from the Mexican Government to supply the city with water and electricity.

QUERETARO, QUER., MEX.—The Ajuchitlan Mining & Milling Company is constructing a hydroelectric plant near its mines in the Queretaro district. It is expected to develop about 400 hp, which will be used in the mines and reduction mill of the company.

TERLINGUA, MEX.—The Chisos Mining Company is installing an electric power plant at its quicksilver mines in this district. The plant will furnish electricity for lamps and motors for the camp.

## New Industrial Companies.

THE BODERICK-BOLTE ELECTRICAL COMPANY, of East St. Louis, Ill., has been incorporated by F. B. Bolte, Charles F. Boderick and Charles Chartrand, all of East St. Louis, Ill. The company is capitalized at \$15,000 and proposes to manufacture electric appliances.

THE COMBINATION TAIL LIGHT & ILLUMINATED AUTOMOBILE NUMBER CORPORATION, of Lewiston, Maine, has been incorporated with a capital stock of \$150,000 to manufacture and sell patent automobile lights and all other electrical appliances. J. Addison Patron, of Winthrop, Mass., is president and treasurer.

THE ELECTRIC TIME RECORDER COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of \$15,000. The incorporators are: Louis S. Heile, Frank T. Milchrist and H. A. Dumas. The company proposes to manufacture electrical and mechanical devices.

THE GARVER TRACK LAYING COMPANY, of Urbana, Ill., has been chartered with a capital stock of \$30,000 to construct steam and electric railways. Taylor Garver, the promoter of the company, is inventor of a track-laying machine operated by compressed air, which it is claimed is capable of laying four miles of track a day. Oliver W. Lamb, of Urbana, Ill., and Harry M. Grant, of Casey, Ill., are among the stockholders.

THE INNER GLOBE LAMP COMPANY, of Boston, Mass., has been chartered with a capital stock of \$125,000 for the purpose of manufacturing and dealing in electrical supplies. W. Hyde, of Boston, Mass.,

is president and S. Washburn, of Dorchester, Mass., is treasurer of the company.

**THE JOHNSON & CAREY COMPANY** has filed articles of incorporation with the Secretary of State, at Dover, Del. The company is capitalized at \$200,000 and proposes to do a general engineering and construction business. The incorporators are: W. T. Carey, C. E. Malin, of St. Paul, Minn., and E. S. Johnson, Bettendorf, Ia.

**THE LANCASTER MOTOR COMPANY**, of Lancaster, N. Y., has been incorporated with a capital stock of \$2,000 by George A. Davis, Frederick Howard, of Lancaster, N. Y., and Odell R. Blair, of Buffalo, N. Y. The company proposes to manufacture engines, motors, automobiles and accessories.

**THE MOORE ELECTRICAL & AUTOMOBILE COMPANY**, of Wilmington, Del., has been chartered with a capital stock of \$50,000 by R. E. Moore, Edward R. Pusey and Enoch Moore, Jr., all of Wilmington, Del.

**THE PORT CHESTER ELECTRIC COMPANY**, of Port Chester, N. Y., has filed articles of incorporation with a capital stock of \$2,500 for the purpose of doing a general contracting business. The incorporators are: Irving M. Austin, Frederick D. Austin and William A. Davidson, all of Port Chester, N. Y.

**THE ROYERS-MYERS MANUFACTURING COMPANY**, of Janesville, Ia., has been organized with a capital stock of \$25,000 for the purpose of manufacturing gasoline engines, concrete mixers and tile machines.

**THE SIEGEL MACHINE COMPANY**, of New York, N. Y., has been incorporated by John Cainein, 465 East 139th Street, Borough of Bronx, New York; S. Levin, 25 East Ninety-ninth Street, New York, N. Y., and Warren McConihe, 42 East Fifty-first Street, New York, N. Y. The company is capitalized at \$5,000 and proposes to manufacture and repair engines, boilers and machinery.

**THE SIMMS MAGNETO COMPANY**, of New York, N. Y., has been incorporated with a capital stock of \$1,000,000 to manufacture magnetos, etc., by V. D. Hecht, H. M. Kelbarn, A. Nathan, C. S. Guggenheimer and M. Stiefel, of New York, N. Y.

**VANDEWATER & COMPANY, Ltd.**, of Elizabeth, N. J., has been incorporated with a capital stock of \$100,000 for the purpose of manufacturing internal combustion engines, steam engines, automobiles, etc. The incorporators are: J. Correja, of Iselin, N. J., and F. C. Vandewater, E. Vandewater and S. R. Vandewater, of Elizabeth, N. J.

**THE WHITE SUPPLY COMPANY**, of the Borough of Bronx, New York, N. Y., has been incorporated by John Doyle, Robert W. Tindall and John T. Clancy, all of New York, N. Y. The company is capitalized at \$10,000 and proposes to deal in chandeliers, lamps, brackets, globes, etc.

**THE W. M. P. MOTOR COMPANY**, of New York, N. Y., has been chartered with a capital stock of \$25,000 by L. R. Walton, F. D. Preston, of New York, N. Y., and L. R. Moody, of Bayside, N. Y. The company proposes to manufacture motors.

### New Incorporations.

**ROBERTSDALE, ALA.**—Articles of incorporation have been filed for the Alabama Telephone & Telegraph Company with a capital stock of \$5,000. The company proposes to operate a telephone system in Baldwin, Conecuh, Escambia, Monroe and Washington counties. The officers are: Ellis L. Munna, president; Spalding Peck, secretary and treasurer, and J. H. Haswell, general manager.

**HELENA, ARK.**—The Lake View Telephone Company has been chartered with a capital stock of \$10,000 by S. Straub, E. M. Allen and others.

**DOVER, DEL.**—The Mexico & Toluca Light & Power Company has filed articles of incorporation with the Secretary of State with a capital stock of \$5,000,000. The incorporators are: H. W. Davis, of Wilmington, Del.; W. S. Woodhull, of East Orange, N. J., and J. C. F. Hickey, of New York, N. Y.

**BONIFAY, FLA.**—Articles of incorporation have been filed for the Bonifay Telephone Company with a capital stock of \$5,000. The officers are: Albert Jernigan, president; C. A. Prim, secretary and treasurer.

**BOISE, IDAHO.**—The Bear & Lick Creek Power Company has been incorporated, with a capital stock of \$500,000 by S. D. Gosbert and others.

**LAPORTE, IND.**—The United Light & Railways Company has been organized to take over the property and holdings of the Laporte Gas Light Company and the Laporte Electric Company and six other public corporations, the controlling interests of which are owned by the Childs-Hulswit syndicate. The company will act as a holding company, and companies in the merger will be operated separately. Frank T. Hulswit is president of the company; Richard Schaddell, first vice-president; Ralph S. Childs, second vice-president and Benjamin C. Robinson, secretary and treasurer.

**OXFORD, IND.**—Articles of incorporation have been filed by the Oxford Telephone Company with a capital stock of \$25,000. The company proposes to construct and operate a telephone system in Oxford and Benson counties. The incorporators are: Joseph W. McConnell, William McConnell and William D. McConnell.

**PITTSBORO, IND.**—The Home Telephone Company, of Pittsboro, has been incorporated with a capital stock of \$3,000 for the purpose of constructing and operating a telephone system in Pittsboro and extending its lines throughout Park County. The directors are: J. D. Gentry, J. F. Leonard, W. E. Beaman, W. M. Dillon and C. O. Suber.

**REDKEY, IND.**—The Redkey Electric Company has been incorporated with a capital stock of \$10,000 for the purpose of generating and transmitting electricity for lamps, heat and motors. The directors are: R. E. Breed, H. L. Finley and Frank B. Ball, all of New York, N. Y. The principal office of the company will be located in Muncie and the place of business will be in Redkey.

**LAKE CHARLES, LA.**—The North Calcasieu Telephone Company has been granted a charter with a capital stock of \$10,000. The officers of the company are: W. B. Welborn, Jr., president; M. A. Shirley, vice-president; C. M. Green, secretary, and S. J. Andrews, treasurer.

**PORTLAND, MAINE.**—The Brunswick Power Company has been granted a charter with a capital stock of \$750,000 for the purpose of doing a lighting and power business. The directors are: Arthur S. Bosworth, treasurer; Frederick O. Conant, Ernest J. Eddy, George F. West, Constant Southworth, and William D. Sewall.

**BRIDGEMAN, MINN.**—The May Northern Telephone Company has been chartered with a capital stock of \$10,000 by F. D. Newkirk, John C. Martin, E. Dalley and J. M. Schmit. John C. Martin is president of the company.

**HAVRE, MONT.**—Articles of incorporation have been filed for the Havre Electric, Steam Heat & Telephone Company with a capital stock of \$200,000 by C. C. Swinbourne and others.

**CAMDEN, N. J.**—The Carbon Electric Company has been granted a charter with a capital stock of \$500,000 for the purpose of manufacturing coal, coke, gas and oil; also generating electricity for lamps and heat. The incorporators are: Charles L. Walton, Walter L. Bowen and H. G. H. Tarr, all of 419 Market Street, Newark, N. J.

**JERSEY CITY, N. J.**—Articles of incorporation have been filed for the East Jersey Light & Power Company by A. Foulds, of Passaic, N. J.; A. W. Bailey and C. E. Robertson, of New York, N. Y. The company is capitalized at \$1,500,000 and proposes to operate light and power plants.

**ARKVILLE, N. Y.**—The Arkville Home Telephone Company has been incorporated with a capital stock of \$1,000 by H. Eugene Genung, Ella Genung, Scudder T. Whipple, all of Arkville, N. Y.

**COLDEN, N. Y.**—The Colden-West Falls Telephone Company has filed articles of incorporation with a capital stock of \$1,500 to erect a telephone line between Colden and West Falls and in the towns of Aurora, Hamburg and Boston.

**SILER CITY, N. C.**—The Vonlee Telephone Company has been incorporated by J. Wade Siler, C. N. Bray and others. The company is capitalized at \$10,000.

**MEDINA, OHIO.**—The Medina County People's Telephone Company has been granted a charter with a capital stock of \$50,000. The incorporators are: C. P. Dickerman, M. E. Branch, Charles Maythem, C. E. Jones and S. W. Batchell.

**CARMAN, TEX.**—The Eagle Chief Telephone Company has been chartered with a capital stock of \$1,000 by R. M. Johnson, S. Terrell, of Carmen, Tex., and A. T. Whitworth, of Augusta, Tex.

**GORDON, TEX.**—Articles of incorporation have been filed for the Gordon Water, Light & Ice Company by J. J. Rice and others.

**PLEASANTON, TEX.**—The Bexar-Atascosa Telephone Company has been formed with a capital stock of \$3,000 to erect a telephone line from Pleasanton to San Antonio, Tex.

**TOPPENISH, WASH.**—The Toppenish Light, Cold Storage & Central Heating Corporation has been organized by A. H. Campbell, of the Reservation Electric Light Company and others. The company proposes to construct electric, ice and central heating plants.

### Personal.

**MADAME CURIE** has been awarded the Albert medal of the (British) Royal Society of Arts for the discovery of radium.

**SIR WILLIAM RAMSAY** has been elected a foreign associate of the Paris Academy of Science to fill the vacancy caused by the death of Alexander Agassiz.

**MR. VALLETTE L. BENEDICT**, of the Los Angeles office of the General Electric Company, has resigned to become manager of the Los Angeles Fire Alarm Company.

**MR. WILLIAM R. WILLCOX**, chairman of the New York Public Service Commission, left New York for Liverpool on the Mauretania, July 14, to spend several weeks abroad.

**MR. W. R. REYNOLDS**, chief electrician of the Municipal Water, Light & Heat Plant, of St. Marys, Ontario, Canada, has been appointed manager of the municipal electric plant at Ingersoll, Ontario.

**DR. JOHN F. KELLY**, on the recommendation of the Franklin Institute, has been awarded by the City of Philadelphia the John Scott medal in recognition of his inventions and improvements in piano players.

**PROF. JOHN W. DORSEY** has resigned as professor of electrical

engineering at the Clarkson School of Technology, Potsdam, N. Y., in order to accept the appointment of lecturer in electrical and mechanical engineering at the University of Manitoba, Winnipeg, Can.

**MR. T. THORNE BAKER**, of London, England, who lectured before the New York Electrical Society on May 11, 1910, has been awarded a silver medal by the British Society of Arts for a paper on the subject of photo-telegraphy, which covered the same ground as his New York lecture.

**MR. F. W. WEBSTER**, general manager of the Stockton (Cal.) Electric Railway Company, has been appointed general manager of the Fresno (Cal.) Traction Company, to succeed Mr. A. G. Wishon, who will devote his time to the management of the San Joaquin Light & Power Company and the Fresno City Water Company.

**MR. OCTAVE CHANUTE**, the Chicago consulting engineer, who was recently removed from Carlsbad to the American Hospital at Paris, suffering from bronchial pneumonia, is reported to be improving. Mr. Chanut has been traveling in Europe studying the design and manipulation of air craft there, a science to the development of which his own investigations have perhaps been the most important contributions.

**MR. VICTOR H. TOUSLEY** has been appointed chief inspector in charge of the Bureau of Inspection of the Department of Electricity of the city of Chicago. Mr. Tousley has served 12 years in the office of which he is now head, having acted for the last five years as assistant to the late chief inspector, Mr. George D. Bayle. Mr. Tousley's promotion was won as the result of civil service examination in which he made the highest mark among a number of contestants.

**MR. HENRY B. OTIS**, who has been identified with the electrical industries of Chicago since 1899, has entered the firm of Charles G. Rush & Co., electrical dealers and contractors, Chicago, and will devote his attention to the power-apparatus department. Mr. Otis was connected with the dynamo testing department of the Western Electric Company from 1899 to 1905, becoming Chicago manager for the Cutter Company of Philadelphia in the latter year. Recently he has been engaged in work for the contract department of the Sanitary District.

**MR. SYLVESTER S. HOWELL** has become associated with Mr. Paul M. Chamberlain, engineer, Marquette Building, Chicago, under the firm name of Chamberlain & Howell. The new firm will carry on the designing and consulting engineer practice established by Mr. Chamberlain. Mr. Howell received his collegiate education at Iowa State College, and since 1887 has given his attention to engineering work. He has had a wide experience in connection with electrical and mechanical installations, resigning a position with the Underfeed Stoker Company of America to form his present connection.

**MR. J. F. JONES** has been appointed by the Wagner Electric Manufacturing Company, of St. Louis, in charge of an office just established by that company in Birmingham, Ala. Mr. Jones was graduated in 1901 from the Alabama Polytechnic Institute with the degree of E.E. and M.E., and immediately thereafter entered the employ of the General Electric Company, of Schenectady, where he worked his way successfully through the testing and inspection departments and finally specialized in the transformer sales department. In November, 1905, he engaged with the Fort Wayne Electric Works, with which he remained in various offices until February, 1909, when he resigned, to take a responsible



MR. J. F. JONES.

position in the home office of the Wagner Electric Manufacturing Company, of St. Louis.

**MR. L. R. POMEROY** has been appointed chief engineer of the railway and industrial division of J. G. White & Company, Incorporated. Mr. Pomeroy was from 1874 to 1880 engaged in commercial business, special auditing, drafting and designing of cars and locomotives. From 1880 to 1886 he was secretary and treasurer of the Suburban Rapid Transit Company, of New York. For four years following this, he was a special representative of the Carnegie Steel Company, introducing basic boiler steel for locomotives and special forgings for railways. For nine years he was engaged in the same work with the Cambria Steel Company and the Latrobe Steel Company, jointly, this assignment involving metallurgical engineering and experimental research to adapt special steels for railway axles, crank pins and piston rods. From 1899 to 1902 he was assistant general manager of the Schenectady Locomotive Works. For six years following this he was a special representative in the railway field for the General Electric Company, this work covering the electrification of steam roads, railway shops, and the general application of electricity for all railway purposes. For the past two years he has been assistant to the president of the Safety Car Heating & Lighting Company. In these lines of work Mr. Pomeroy has devoted a large portion of his time to consulting work in the special field of railway shops, machine tool operation and the adaptation of tools to the work, with special reference to sequence of operation and general efficiency.

## Obituary.

**MR. WILLIAM McINNES**, who claimed to have been the inventor of the electrical hotel annunciator, died at Belvedere, N. J., on July 11, at the age of 80. Mr. McInnes was for many years a telegraph operator in the employ of the Western Union Telegraph Company.

**MR. JAMES BIGLER**, who in 1879 organized the Newburgh (N. Y.) Telephone Company and, with the Western Union Telegraph Company, owned most of its stock, died in Newburgh on July 16, aged 92 years. For some years he was president of the Hudson River Telephone Company, which laid the first telephone cable under the Hudson River.

**MR. ALBERT E. SILK**, manager of the Chicago office and store of the Jewell Belting Company, of Hartford, Conn., died suddenly in Detroit on July 12 and was buried in that city two days later. Mr. Silk, who was 50 years of age, had been with the Jewell company for a number of years, and he had an exceptionally wide acquaintance in the belting trade. His wife survives him.

**MR. ALOIS MIRCHING**, who assisted in the development of a stock quotation ticker while superintendent of the early electrical apparatus manufacturing firm established by Mr. Charles T. Chester, died in Brooklyn, N. Y., on July 14. Mr. Mirching was born in Vienna 78 years ago. He came to New York when 17 years old and took up the study of electrical subjects when electrical engineering was in its infancy. He is survived by four sons and four daughters.

**DR. MIHRAN K. KASSABIAN**, a physician and surgeon who spent the last few years experimenting with X-ray apparatus, died in Philadelphia on July 11 as a result of the burns received during his experiments. Dr. Kassabian was born in Asia Minor in 1868 and was educated in a missionary school in Argens, where he afterward taught the school. He came to this country in 1894 and entered the Medico-Chirurgical College. His studies were interrupted while he was serving his adopted country in the hospital corps during the Spanish War. On his return from the war he received his diploma and was appointed instructor in electro-therapeutics and skiagrapher in the Medico-Chirurgical College. In 1902 he resigned that position and was appointed director of the Roentgen Ray Laboratory and lectured on the Roentgen ray in the Philadelphia General Hospital. He published in 1907 a book that has been used as a college text, being now in its second edition. Dr. Kassabian had been delegate to international congresses of X-ray operators in many parts of the world. His papers on the subject are numerous, and in none of them does he refer in any way to the dangers of X-ray experimentation. In 1902 his hands were constantly burned, but he adhered to his purpose to improve the system and to wring from it the still hidden benefits. Two years ago two fingers of his left hand were amputated because the cancerous malady produced by the burns had spread through them. The operation had no effect to check the progress of the malady. About a year ago several glands were removed from the left arm pit, but this operation also failed to stop the disease. Last month the pectoral muscles were removed from his chest, and he had been out of the hospital only two weeks when he went back to die.

## Trade Publications.

**ELECTRIC IRONS.**—The American Electric Heater Company, Detroit, Mich., is distributing mailing folders devoted to heating devices with special notice of electric irons.

**CIRCUIT BREAKERS.**—The Cutter Company, Philadelphia, Pa., has issued in book form a well-prepared treatise on circuit breakers for protecting all kinds of electric circuits.

**SIGN FLASHERS.**—The Reynolds Electric Flasher Manufacturing Company, 191 Fifth Avenue, Chicago, Ill., has issued bulletin No. 11 with a supplement relating to electric sign flashers.

**ICE MACHINERY.**—A neatly executed bulletin of the Carbondale Machine Company, Carbondale, Pa., deals with machinery for making ice by means of the exhaust steam from power plants.

**FEED-WATER HEATERS.**—The Whitloch Coil Pipe Company, Hartford, Conn., has issued a 78-page loose-leaf catalogue covering feed-water heaters, exhaust heads, separators and other steam-heating specialties.

**POLYPHASE INDUCTION MOTORS.**—A line of induction motors ranging in power from 316 hp to 200 hp is described and illustrated in a bulletin recently issued by the Lincoln Electric Company, Cleveland, Ohio.

**TIME SWITCHES.**—The Williams Time Switch Company, 47 John Street, New York, has issued a folder devoted to time switches designed for automatically controlling the time of use of any desired electric service.

**LIFTING MAGNETS.**—The Cutler-Hammer Clutch Company, Milwaukee, Wis., has issued a folder relating to lifting magnets, the details of which are well shown in a cross-sectional view which is fully explained.

**PUMPS.**—Electric motor-driven twin-volute turbine pumps for house tank and similar service are illustrated and described in mailing folders being distributed by the Watson-Stillman Company, 50 Church Street, New York.

**INDUCTION MOTORS.**—Bulletin No. 600, of the Sprague Electric Company, 527 West 34th Street, New York, gives much interesting data relating to induction motors of the single-phase, polyphase and commutator types.

**OIL ENGINES.**—Mirrless, Bickerton & Day, 225 Gresham House, Old Broad Street, London, England, have issued an illustrated bulletin dealing with Diesel oil engines, which are stated to consume not over 0.5 lb. of oil per hp-hour.

**VIBRATORS.**—Motor-driven vibrators, massage machines, hair dryers, centrifugal machines and therapeutic appliances are illustrated, described and listed in a bulletin issued by the Shelton Electric Company, 105 West 42d Street, New York.

**MAGNETO-GENERATORS.**—Bulletin No. 157B, of the Holtzer-Cabot Electric Company, Brookline, Mass., gives much detailed information relating to magneto-generators and spark-coils for use with marine, stationary and automobile engines.

**COMBUSTION RECORDER.**—Automatic devices for recording the amount of carbon dioxide present in flue gases are well discussed in an illustrated bulletin issued by the Precision Instrument Company, 49 Larned Street West, Detroit, Mich.

**RAILWAY MATERIAL.**—Catalogue No. 10, of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., is a 200-page publication in which are listed and described all varieties of direct suspension line material for low-voltage railways.

**PRESSURE RECORDERS.**—The Precision Instrument Company, 49 Larned Street West, Detroit, Mich., is distributing bulletins devoted to Wright pressure and vacuum recorders and indicators for showing the condition of supply of steam, gas, water or air.

**PORTABLE LAMPS.**—In its general catalogue, the McKenna Brass Company, First Avenue and Ross Street, Pittsburgh, Pa., are shown portable electric lamp desk stands, electric wall and desk fixtures with sliding lamps and stationary electric lamp desk stands.

**ELECTRICAL TESTING SETS.**—Circular No. 510 of the Thompson-Levering Company, 244 Arch Street, Philadelphia, Pa., describes in detail switch-dial and testing sets designed for making measurements of resistance, voltage and current, and locating faults in cable circuits.

**STEAM TRAPS.**—Bulletin No. 267 of the American Blower Company, Detroit, Mich., deals with traps which are said to be applicable anywhere that steam is used, for whatever purpose, and can be used for draining any system on which a pot float or bucket trap is now, or would be, used.

**ELECTRICAL SPECIALTIES.**—The Fairmont Electric & Manufacturing Company, Philadelphia, Pa., has issued a perpetual loose-leaf catalogue dealing with pot-heads, arc-lamp hangers, conduit fittings, electrolier fittings, ground clamps and test connectors, which are illustrated, described and listed.

**INSULATING VARNISHES.**—The Sterling Varnish Company, Pittsburgh, Pa., has issued a catalogue devoted to elastic and extra elastic insulating varnishes. It is also distributing samples of cloth covered with varnish which is said to withstand a temperature of 212 deg. Fahr. without being affected.

**PRECISION INSTRUMENTS.**—James G. Biddle, 1114 Chestnut Street, Philadelphia, has recently issued a 16-page bulletin (No. 735) which describes a new type of precision indicating wattmeter, as well as precision current and potential transformers. These instruments are made by Siemens & Halske, of Berlin.

**RECORDING INSTRUMENTS.**—The Bristol Company, Waterbury, Conn., has issued as a neatly executed 64-page bulletin an illustrated index of recording instruments. The publication is not a catalogue but rather a set of illustrations of the most important models of instruments for recording pressure, temperature, current, voltage, power or time of mechanical movements.

**DISTRIBUTING APPARATUS.**—Under the title "Electrical Distributing Apparatus," the J. Lang Electric Company, of 421-429 Lincoln Street, Chicago, issues its general catalogue No. 810. Knife switches, fuses, plugs and receptacles, floor boxes, panel boards, cabinets, switchboard panels, and other fittings are illustrated and described. Prices are given, and the catalogue makes an attractive book of 96 pages.

**BELT-DRIVEN ALTERNATORS.**—Bulletin No. 4738 of the General

Electric Company describes three sizes of polyphase, 60-cycle generators for use in small isolated plants. These generators are of the belt-driven revolving-armature type, and are designed for service at any power factor between 0.8 and 1.0. They range in rating from 7.5 kw to 25 kw and are designed for 120 volts, 240 volts, 480 volts and 600 volts.

**TELEPHONE POWER PLANTS.**—Bulletin No. 1008, describing telephone power plant equipments for non-multiple switchboards, has been issued by the Western Electric Company. It contains 24 pages and is illustrated with many diagrams and cuts. This bulletin presents some features of apparatus designed especially for telephone plants. The subject matter covers only such apparatus as is required for non-multiple switchboards up to 800 lines.

**ELECTRICAL HARDWARE.**—In a bulletin entitled "House Goods" the Western Electric Company lists a complete line of electrical apparatus used for convenience in modern buildings. Among the items are annunciators; bells and buzzers; burglar alarms, with a dozen types of springs to fit windows, transoms, doors, etc.; heating devices, including chafing dishes, percolators, electric irons, warming pads, curling iron heaters; fire alarm thermostats; dozens of types of lighting fixtures; medical batteries; push buttons, in all the different forms and finishes, arranged for ringing one or many different bells; electric massage vibrators; watchmen's registering systems; door switches for automatically lighting a lamp when a door is opened; convenient lamp holders with adjustable cord for taking an electric lamp into a closet or other places not regularly lighted; washing machines; vacuum cleaners; sewing machine motors; inter-phones, or private line telephones for room-to-room or house-to-garage communication.

## BUSINESS NOTES.

**THE PACIFIC STATES ELECTRIC COMPANY** has opened an office in Portland, Ore., where a complete stock of electrical supplies, instruments and apparatus will be carried.

**THE WRIGHT WRENCH MANUFACTURING COMPANY**, Canton, Ohio, has changed its name to The Wright Wrench & Forging Company. This company has just moved into its large new factory covering several acres of ground, which gives ample room for its fast growing business. Its plant includes a forging department and it is prepared to take care of a general forging business in addition to the manufacture of quick adjustable wrenches.

**CIRCUIT-BREAKERS FOR CHICAGO TERMINAL POWER HOUSE.**—The Cutter Electric & Manufacturing Company, through its Chicago office, recently closed a contract for the circuit-breakers for the Chicago & Northwestern Railway Company's terminal power house in Chicago. The equipment, as specified by Pierce, Richardson & Neiler, consulting engineers, is composed of I-T-E motor-operated remote-control circuit-breakers and switches for the protection of the engine, turbine and motor-driven generators. This apparatus is so constructed that, whether being operated electrically from the control board or manually at the breaker, it cannot be held closed against an overload or reversal of current, and is equipped with direct-acting inverse-time-limit "Dalite" devices throughout.

**NEW SHOP FOR GREEN FUEL ECONOMIZER.**—The Berlin Construction Company has received the contract for rebuilding the fan shop of the Green Fuel Economizer Company, at Matteawan, N. Y., which was almost totally destroyed by fire some weeks ago. It is expected to have the new building erected and complete, ready for occupancy, about the middle of August. The new shop will have about 25 per cent more floor space than the old shop, including a test room fully equipped with chambers, gages, etc., suitable for making exhaustive tests on the capacity, pressure and efficiency of the improved fans built by this concern for heating and ventilating, mechanical draft, and other services. The new building will be of steel construction throughout, and will be heated by the hot-blast system, with frequent outlets near the floor to secure uniform distribution of the heat. This system has been applied by the Green Fuel Economizer Company with great success in several buildings that were peculiarly difficult to heat, such, for instance, as the new foundry of the Waterbury Castings Company, where the wall surface is almost entirely of glass.

## Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 12, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

963,735. **ELECTRIC SWITCHING DEVICE;** C. Aalborg, Wilkinsburg, Pa. App. filed April 10, 1908. Induction regulator driven by an electric motor controlled by a switch of special construction.

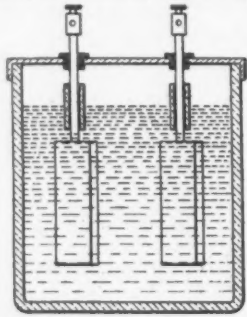
963,736. **ELECTRIC ARC LAMP;** T. E. Adams, Cleveland, Ohio. App. filed July 14, 1909. An electrode carrying a blade consisting of members parallel with the axis of the electrode and projections spaced apart and connecting said member.

963,745. **PROCESS OF MAKING INCANDESCENT ELECTRIC LAMP FILAMENTS;** W. G. Clark, New York, N. Y. App. filed April 5, 1906. Coats a filament with silica.

963,755. **MOTOR SADDLE;** H. W. Forslund, Chicago, Ill. App. filed Dec. 14, 1906. Electric hoist for elevators in which the motor is suspended from the ceiling by a particular form of saddle.

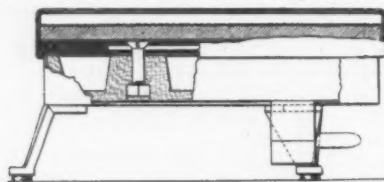
963,762. **PROTECTIVE DEVICE FOR ELECTRIC APPARATUS;** F. W. Harris, Wilkinsburg, Pa. App. filed May 6, 1907. A thermostat in spiral form for protecting electric circuits.

- 963,763. **ELECTRIC THERMOSTAT**; F. W. Harris, Wilkensburg, Pa. App. filed May 6, 1907. A thermostat in spiral form with magnetizable plates between and at the outer sides of the spiral and an armature of magnetic metal perpendicular to the plates.
- 963,764. **ELECTRIC CIRCUIT INTERRUPTER**; F. W. Harris, Wilkensburg, Pa. App. filed May 6, 1907. Spiral thermostat to act on a latch to open the switch which controls an electric circuit.
- 963,809. **PROTECTIVE DEVICE FOR ELECTRODES**; Theodore Sahrig, Berlin, Germany. App. filed Sept. 25, 1906. Protector for aluminum cells in which the covering for the electrode extends below the fluid level and is composed of rigid material which resists the chemical effect of the electrolyte.
- 963,817. **DIPPING MECHANISM FOR ELECTROPLATING APPARATUS**; J. H. Shaw, New Haven, Conn. App. filed May 3, 1900.



963,809—Protective Device for Electrodes.

- A rotary carrier supporting a work holder which when rotated raises or lowers the holder.
- 963,825. **LIMIT SWITCH FOR MOTOR OPERATED DEVICES**; H. A. Steen, Pittsburgh, Pa. App. filed Dec. 2, 1909. Includes a shaft, a sleeve rotatable thereon carrying contact fingers and rotated by a spring and a latch for holding the sleeve.
- 963,830. **LIGHTNING ROD CONSTRUCTION**; T. Thompson, Burlington, Iowa. App. filed April 20, 1910. A conductor with a tubular member and an angular tube and a coupling connecting it to the conductor.
- 963,843. **SIGNALING APPARATUS**; G. M. Willis, Chicago, Ill. App. filed Jan. 10, 1908. Watchmen's signal, including a make-and-break mechanism for causing a code signal controlled by a key to be sent over the line.
- 963,846. **INSULATED JOINT**; G. Wright, Schenectady, N. Y. App. filed Feb. 2, 1910. Joints for gas pipes and electric fixtures consisting of two nipples with square flanges and an interposed sheet of insulation.
- 963,852. **GALVANIC BATTERY**; S. Benko, Budapest, Austria-Hungary. App. filed Jan. 19, 1909. Operates batteries by passing the electrolyte containing a depolarizing gas through the pores of a negative electrode by creating alternately a pressure and then a vacuum on one side of the electrode.
- 963,859. **CIRCUIT BREAKER**; E. A. Burrows, Chicago, Ill., and F. P. McIntosh, Elkhart, Ind. App. filed April 9, 1906. High-potential switch immersed in oil operated by a solenoid controlled by a push-button.
- 963,865. **PANTOGRAPH TROLLEY**; F. E. Case, Schenectady, N. Y. App. filed Feb. 25, 1909. Has pivoted standards carrying a traveling contact and raised by springs.
- 963,867. **ELECTRIC-CONTROL SYSTEM**; W. M. Chubb, San Francisco, Cal. App. filed July 12, 1909. For controlling motors by means of a divided circuit containing a resistance which actuates a solenoid and an iron core moved by the solenoid to cause a contact point to move to a point of like potential in the circuit.
- 963,872. **LAMP FILAMENT**; W. D. Coolidge, Schenectady, N. Y. App. filed Aug. 1, 1906. Colloid of a low melting metal incorporated with a refractory powder.
- 963,879. **JUNCTION BOX**; J. R. Duff, New York, N. Y. App. filed Nov. 13, 1906. Has a ring-shaped electric terminal connecting member and star-shaped connecting member supported on the ring member.
- 963,892. **ELECTRIC HEATER**; C. D. Haskins, Schenectady, N. Y. App. filed June 23, 1909. The heating surface is softened by the heat developed in the heater.
- 963,897. **TIME LIMIT RELAY**; E. H. Jacobs, Schenectady, N. Y. App. filed Feb. 23, 1909. A tripping member such as a latch of a circuit breaker is struck a hammer blow by the core of a solenoid



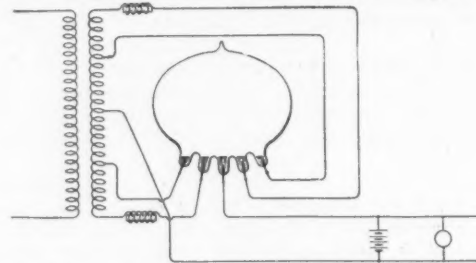
963,892—Electric Heater.

overload coil, the time limit being secured by a retarder such as a bellows.

- 963,907. **ELECTROMAGNET COIL**; C. B. Larzelere, Schenectady, N. Y. App. filed March 29, 1909. A bar of conducting material of rectangular cross-section with a hole through it and intersecting slots.
- 963,980. **APPARATUS FOR THERMOCHEMICAL GENERATION OF ELECTRICITY**; L. P. Bassett, Paris, France. App. filed March 26, 1906. Carbon electrodes divide the vessel into compartments, subdivided by porous walls.
- 963,996. **ELECTRIC SWITCH**; J. L. Creveling, New York, N. Y. App. filed May 28, 1908. For closing a circuit automatically between generator and storage battery when the voltage reaches a predetermined point by means of an electromagnetic switch with a movable member of low magnetic reluctance.
- 964,015. **ELECTRICITY MEASURING INSTRUMENT**; J. Gorner, Eschersheim, near Frankfurt-on-the-Main, Germany. App. filed Aug.

31, 1906. For alternating currents with a shunt in series, electromagnet for producing a shifting field and a choking circuit co-operating with the series magnet.

- 964,033. **GENERATOR APPARATUS**; O. M. Leich, Genoa, Ill. App. filed June 19, 1908. Magneto generator in which foucault currents are prevented by means of a slotted armature.
- 964,037. **CONTROLLING MEANS FOR ELECTRIC CIRCUITS**; J. K. Lux, Jersey City, N. J. App. filed Sept. 2, 1909. Single pole snap switch with a torsional spring with means for releasing the movable contact after the spring has been put under tension.
- 964,086. **FIRE-ALARM SYSTEM**; W. Carroll, Chicago, Ill. App. filed Feb. 11, 1909. Trouble on the line will not produce a false alarm and the signal box in any room communicates an alarm to central and indicates the room in which the fire is located.
- 964,096. **PROCESS OF ELECTROPLATING**; Thomas A. Edison, Llewellyn Park, Orange, N. J. App. filed March 19, 1906. Chlorinates copper sulphate solution and adds to a copper plating bath as the chlorin becomes exhausted by reaction with the hydrogen on the cathode.
- 964,145. **MICROPHONIC TRANSMITTER**; C. L. Chisholm, Marysville, New Brunswick, Canada. App. filed Aug. 5, 1908. A carbon diaphragm metal plated on its edge.
- 964,169. **CURRENT INTERRUPTING DEVICE**; O. M. Leich, Genoa, Ill. App. filed June 19, 1908. Form high-frequency currents produced by an induction coil with a make-and-break apparatus connected with a condenser circuit.
- 964,171. **CIGAR TIP CUTTER AND LIGHTER**; H. F. Lichty, Creston, Iowa. App. filed Aug. 16, 1909. A pivoted lamp supporting standard carrying a contact for co-operation with the first-mentioned contact and a movable operating member for communicating motion to the standard, with co-operating contacts carried by the standard and the operating member so as to automatically light the cigar-igniting lamp when the cigar is cut.
- 964,197. **PORTABLE ELECTRICAL TOOL**; F. J. Backscheider, Cincinnati, Ohio. App. filed Feb. 8, 1909. The driving and driven shafts are yieldingly connected and a mechanical construction operates to break the circuit when the tool becomes stalled, particularly by means of a connecting gear.
- 964,214. **TELEPHONE TRANSMITTER**; C. L. Chisholm, Marysville, N. Y. App. filed May 9, 1909. The diaphragm is supported on its periphery without stress and has a fundamental rate of vibration higher than that of the normal voice waves.
- 964,268. **APPARATUS FOR SMELTING ORES YIELDING A VOLATILE METAL**; W. McA. Johnson, Hartford, Conn. App. filed Nov. 9, 1906. For smelting ores in an electric furnace containing a porous body of carbonaceous material, a condenser and ring electrodes.
- 964,274. **ELECTRIC PLAYING APPARATUS FOR MUSICAL INSTRUMENTS**; John F. Kelly, Pittsfield, Mass. App. filed Sept. 14, 1907. The hammers, etc., are operated by electromagnets controlled



964,336—Means for Maintaining Vapor Converters in Operation.

- by a perforated record sheet and the loudness of the tones is varied by changing the tunes of the magnet winding.
- 964,281. **ELECTRIC LAMP HOLDING SOCKET**; H. Wallace Lawrence, Denver, Col. App. filed July 16, 1909. Details in the construction of a lamp socket.
- 964,297. **LIGHTNING ROD UPRIGHT**; G. J. Moore, Maryville, Mo. App. filed Feb. 10, 1910. The lower end has a loop to receive the rod and the upper end is tapered to provide a point.
- 964,312. **VIBRATOR**; A. Pfanstiel, Highland Park, Ill. App. filed Feb. 1, 1910. Current interrupter for induction coils with a stationary anvil plate, a vibratory ring carrying an armature and a plate having a sliding adjustment on its base for adjusting a tension spring.
- 964,336. **MEANS FOR MAINTAINING VAPOR CONVERTERS IN OPERATION**; P. H. Thomas, East Orange, N. J. App. filed Dec. 24, 1903. For charging storage batteries in which the converter has a plurality of main positive electrodes, a plurality of auxiliary positive electrodes, a common negative electrode and a source of accelerated electromotive force.
- 964,343. **ROTARY FIELD MAGNET**; E. Volkens, Berlin, Germany. App. filed April 2, 1909. A rotary field magnet including a number of permanent magnets of spiral shape.
- 964,376. **INSULATOR SUPPORT**; J. Blackburn, Kirkwood, Mo. App. filed July 17, 1909. A pin, a base at right angles thereto, jaws embracing a crossarm and engaging the base, the jaws being secured to the crossarm.
- 964,418. **ELECTROMAGNETIC CIRCUIT CONTROLLER**; H. G. Geissinger, New York, N. Y. App. filed Dec. 23, 1909. For motor starters and the like in which an electromagnet has an armature and energizing coils for lifting and retaining the armature respectively, the lifting coil being in series with the translating mechanism and the retaining coil between the main conductors.
- 964,459. **MANUFACTURE OF METALLIC SILICIDES**; G. Strauss, Paris, France. App. filed April 16, 1908, and Oct. 26, 1909. Heats calcium carbide with silica in an electric arc.
- 964,474. **MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS**; D. J. O'Brien, San Francisco, Cal. App. filed July 22, 1904. For making tube lamps by preparing the tube for exhaustion, glanding the tube, inserting the filament and anchoring the ends to the glands, capping the glands and fitting them for connection to an electric circuit, and then exhausting the air and sealing the tube.
- 13,130. (Reissue.) **TELEGRAPHIC TRANSMITTER**; P. Dinger, Cleveland, Ohio. App. filed May 17, 1909. A vibrator transmitting dots and a short lever pivoted adjacent thereto, a spring checking it, dash contacts and a key lever controlling the lever and contacts.